RANDOMIZED CLINICAL TRIAL EXAMINING THE EFFICACY OF AN ELECTRONIC INTERVENTION FOR HIV MEDICATION ADHERENCE

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This project is dedicated to the members of the HIV community. I hope that this study will aid in the advancement of treatment and improved quality of life for this population. Moreover, I hope that it will inspire more interest in the development of more effective and innovative prevention and intervention methods for improving adherence to HIV regimens. It is my hope that this work will be used for a higher purpose and lead to sustained behavior changes within the lives of those living with HIV.

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CHAPTER I

INTRODUCTION

The development of effective antiretroviral medications transformed treatment for individuals living with HIV. Strict adherence to medical regimens is essential for ideal treatment of patients living with HIV, yet significant barriers result in most patients failing to achieve adequate adherence (Chesney et al., 2000; Friedland, 2006). Nonadherence to prescribed antiretroviral medications may result in failure to achieve viral suppression and increased HIV replication and may lead to the development and transmission of drug resistant strains of HIV. Consequently, health care providers increasingly are offering patients assistance with medication adherence to reduce the chances of treatment failure and to decrease development of drug resistant strains being transmitted to the public (Smith, Golin, & Reif, 2004).

Currently, HIV medication regimens are individually tailored to the patient, therefore the number of pills and how often the patient is required to take the medication varies. Most regimens require multiple pills throughout the day, some of which must be taken on an empty stomach while others must be taken with meals or before or after

doses of other medications. This complex regimen poses multiple barriers to adherence and many lifestyle challenges for people prescribed antiretroviral medications.

Additionally, numerous biological, behavioral, and social factors influence medication adherence. The most commonly reported deterrents of adherence among patients are adverse side effects of the regimen, large numbers of pills, and dosing restrictions (i.e., frequency and requirement of food or water). Behavioral factors, which often lie at the root of treatment failure, include accurate knowledge regarding the regimen, cognitive functioning (i.e., remembering the regimen and having the capacity to understand dosing requirements), motivation, and skills (Friedland, 2006). Many patients report forgetting to take the medications, especially when they are not at home; being uncertain about how to take the medications; and believing that they cannot adhere to the strict regimen requirements (Roberts, 2000)(K. J. Roberts, 2000). Implementing the medication regimen into daily life and being unable to take medications privately while at work or in public pose a significant barrier to patients. It is imperative that health care providers address these issues with patients, particularly with newly diagnosed patients, those beginning a new regimen, and those who are identified as nonadherent.

Health care providers have implemented a variety of behavioral interventions designed to promote adherence to medication regimens. Many of these interventions are multi-component and consist of memory-prompting devices (i.e., medication cards, pillboxes), increased social support, and motivational strategies. In a review of 88 descriptive and intervention studies, Sandelowski and colleagues (2009) found that cognitive behavioral interventions were most prevalently used to address problems with medication adherence. These interventions were directed toward knowledge, beliefs about HIV infection and antiretroviral therapy (ART), social support, and behavioral strategies. Multiple studies have

demonstrated that medication adherence is not a static, one-dimensional behavior; rather, multiple emotional, cognitive, and behavioral factors that frequently change influence adherence (Johnson, et al., 2003, Remien, Hirky, Johnson, Weinhardt, Whittier, & Le, 2003; Sandelowski, Voils, Chang, & Lee, 2009). Thus, effective interventions should target each of these factors, including components of education, skill-building, motivation enhancement, and problem-solving techniques (Johnson et al., 2003).

The *Life Steps* program is a brief adherence intervention that combines components from several empirically validated intervention approaches, including both Brief Motivational Interviewing (BMI) and Cognitive Behavior Therapy (CBT), which has been effective in increasing medication adherence among patients with HIV. Safren and colleagues developed the *Life Steps* program based on principles of CBT, BMI, and problem-solving therapy to help patients identify and solve problems with medication adherence (Safren et al., 2001). This brief, single-session intervention is designed to provide patients with education and training in medication adherence. Safren and colleagues (2001) compared the *Life Steps* program to self-monitoring of medication adherence, which has also been supported in the empirical literature. Results demonstrated improvements in adherence in both conditions at two weeks posttreatment and 12-weeks posttreatment; however, the *Life Steps* condition showed faster improvements in adherence rates than the self-monitoring condition. This suggests that the inclusion of problem-solving and motivational interventions can be an effective tool for increasing medication adherence within a brief, single session therapeutic format.

While the evidence for *Life Steps* is promising, the dissemination and adoption of the program is limited by several practical barriers, including the expense of professional staff, training needs, time demands upon staff in the clinical environment, and concerns about treatment fidelity. The development of a brief, computerized intervention adapting the components of *Life Steps* and targeting medication adherence may reduce the already demanding time constraints placed on physicians and health care providers. Further, this intervention will be economically feasible, cost-effective, and easily disseminated among patients who are at-risk for nonadherence, particularly patients who are initiating treatment, changing regimens, or have demonstrated previous failures to adhere to the regimen. This program could be delivered via local computer or tablet device and included on a compact disc or made available via the internet, allowing easy access to developing skills for adherence and periodic review of procedures for patients outside of the clinical setting. An electronic computer-based intervention would provide a standardized method intervention which would greatly assist health care providers who currently have limited time constraints and resources to provide such an intervention.

The purpose of the current study was to develop and test a multimedia electronic intervention (*Electronic Life Steps*, or *eLS*) for improving adherence to antiretroviral therapy treatments among patients living with HIV. We hypothesized that individuals who completed the *eLS* intervention would (1) report high satisfaction with the computer-based program; (2) demonstrate higher self-efficacy to adhere to their prescribed antiretroviral medication regimen; and (3) demonstrate greater self-reported adherence at follow-up.

CHAPTER II

METHODOLOGY

This study was conducted in an outpatient community health center in Tulsa, OK which primarily serves persons infected with HIV. This study was approved by the Institutional Review Board. Voluntary, written informed consent was obtained from all participants. The trial was registered at clinicaltrials.gov (NCT01291485). Full details of the trial protocol can be found in Appendix D and available at www.who.int/ictrp/en.

Participants

Participants were recruited for this study from an outpatient clinic that serves primarily patients living with HIV. Patients were eligible for enrollment in the trial if they met the following inclusion criteria (a) infected with HIV, (b) at least 18 years of age, (c) currently prescribed a Highly Active Antiretroviral Therapy (HAART) regimen, (d) prescribed a drug regimen for the first time, were changing regimens, or reported adherence below 95%, and (e) agreed to a brief follow-up interview. Participants were excluded from the study if they presented with a physical impairment that would prevent them from successfully completing the computer-based program (e.g., blind, deaf, severe

neurpsychological impairment), reported being actively psychotic, or were not fluent in the English language. Participants who met the screening criteria were randomly

assigned to one of the following conditions: (1) Treatment as usual (TAU; N = 50) or (2) TAU + *Electronic Life Steps* intervention (N = 47). Blocked randomization was used to ensure close balance of the numbers in each group throughout the trial. For every block of 10 participants, five were allocated to each arm of the trial.

Design and Procedures

After providing written consent to participate in the study, all participants completed a brief questionnaire which assessed demographic information, adherence to HIV medications (*AACTG Medication Adherence Questionnaire*), and confidence and commitment to adhere to the prescribed HIV regimen.

Intervention Condition

The *Electronic Life Steps (eLS)* experimental intervention was developed on the basis of prior studies of interventions designed to improve HIV medication adherence and was based on components of brief motivational interviewing, cognitive behavioral therapy, and problem solving training (Safren, Otto, & Worth, 1999). The intervention was delivered in a single-session format. Completion of the intervention varied by participant and ranged from 33 minutes to approximately 90 minutes. The program features an audio interviewer that guides the user through the program, video examples, and problem-solving modules that encourage the user to engage in personalized reflection and planning. The program utilizes an accompanying workbook with a number of worksheets that the user is encouraged to complete while progressing through the intervention on the computer.

Consistent with the original *Life Steps* intervention, the assessment intervention itself included 10 informational, problem-solving, and cognitive behavioral steps, each presented as a separate module (see Table 1 for module descriptions). Completion of one module directs the participant directly to the subsequent module. After the intervention, participants completed several additional questionnaires designed to assess self-efficacy to adhere to HIV regimen (*HIV Treatment Adherence Self-Efficacy Scale*), readiness to adhere to the treatment regimen *(HIV Medication Readiness Scale),* quality of life (*McGill Quality of Life Questionnaire*), and intervention satisfaction (*The Program Satisfaction Questionnaire*). Participants in the TAU condition completed these measures with the demographics and adherence measures at baseline. Participants were entered into a drawing to win a portable DVD player at completion of the baseline assessment. Each participant received $5 upon completion of the follow-up assessment interview which was scheduled at 1-month for both the intervention and control groups.

Measures

Demographics Questionnaire. Basic demographic data was collected including information regarding gender, age, ethnicity, current living situation, marital status, sexual orientation, educational attainment and treatment history.

Medication Adherence. Self-reported adherence to HIV medications was assessed using the AACTG Medication Adherence Questionnaire (Chesney et al., 2000). This measure queries patients on the number of doses missed of each medication during each of the last four days. Additionally, other adherence behaviors are assessed such as following specified instructions, missing doses on the weekend, and how closely the

patient followed the specific schedule. Adherence was calculated by averaging the total number of pills taken over 4 days divided by the total number of pills prescribed. Scores range from 0-100%, with higher scores indicating a greater level of adherence.

HIV Treatment Adherence Self-Efficacy. Self-efficacy for adherence to HIV medications was assessed using the HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES; Johnson, Neilands, Dilworth, Morin, Remien, & Chesney, 2007). The HIV-ASES is a 12-item scale of patient confidence in their ability to carry out behaviors related to adhering to medication regimens. Responses range from 1 ("cannot do it at all") to 10 ("completely certain can do it"). Item scores are averaged with higher scores indicating higher adherence self-efficacy. Analysis of the HIV-ASES has revealed robust internal consistency (.90) and reliability (.91).

Commitment to Adhere to HIV Medication Regimens. This item was developed for the purposes of this study and consists of a single question addressing the participant's level of commitment to adhere to the currently prescribed antiretroviral medication regimen. Responses range from 0 ("not committed at all") to 10 ("completely committed") with high scores demonstrating higher levels of commitment to adherence.

Clinical outcomes. Medical records for each subject were reviewed for the most recent laboratory test results of CD4+ cell counts and viral load. These records were reviewed four weeks after baseline assessment and within two weeks after each follow-up point. This time frame allowed the investigators to access the most recent clinical data relevant to the time point.

Program Satisfaction Questionnaire. This questionnaire was developed for the purposes of this study to address the level of satisfaction with the intervention. This questionnaire consists of eight items assessing level of agreement or disagreement with the statement, such as "I would recommend this program to a friend" and "I learned new things from the program."

CHAPTER III

RESULTS

Participant Characteristics

Table 2 provides details of the participant characteristics for each randomization group. The sample was predominantly male, with 59% identifying as White, 21% as African-American, and 11% as American Indian. The mean age was 44 years. The sample was balanced across randomization conditions with regard to all demographic variables.

Assessment and Intervention Completion Rates

Of the 97 individuals enrolled in the trial and randomized, 71% completed the 1-month follow-up assessment. Of the 47 individuals randomized to the intervention condition, 43 (93.5%) completed the first session and 32 (74.4%) completed the 1-month follow-up. See Figure 1 for the clinical trial participant flow details. Attrition rates across the two conditions were not different $\chi^2(1, 97) = 0.79$, $p = .375$. The attrition rate between baseline assessment and 1-month follow-up was 25%. Reasons for attrition are as follows: (1) death ($N = 1$); (2) hospitalization ($N = 1$); and (3) unable to be contacted via phone, email, or at scheduled medical appointments ($N = 21$).

Attrition is a common challenge to HIV clinical trials. Amico, Harman, & O'Grady (2009) reviewed 51 studies and found that the mean attrition rate was 30% for the study sample of HIV intervention trials with some studies reporting attrition rates as high as 60-77%. The attrition rate within this study falls within the expected range for HIV clinical trials. High levels of attrition can bias results and present threats to validity; however, this is only problematic if there are systematic differences between participants who completed the study and those who dropped out (Hansen, Collins, Malotte, Johnson, & Fielding, 1985 as cited in Grant, Beck, Farrow, & Davila, 2007). To examine this possibility *t*-tests and chi-square tests were conducted between participants who completed the study and those who dropped out prematurely on demographic variables and variables used in the main analyses. No significant differences were found between groups on either demographic variables or variables used in the primary analyses (see Table 4). Consequently, the effect of attrition on study conclusions should be minimal. For participants with missing data, regression mean imputation was used to calculate the predicted missing variables which were then substituted for each unit with a missing value. Additionally, analyses were examined excluding participants who did not complete the study (see Appendix E for additional analyses).

Randomization check and preliminary analysis

Chi-square analyses were conducted to test for any significant condition differences with regard to gender, ethnicity, education, marital status, and sexual orientation across conditions, with no significant differences found (all $p>.05$). A *t*-test was conducted to determine if significant condition differences existed with regard to

baseline $CD4^+$ cell count ($p<.01$) and viral load ($p>.05$), revealing a significant difference between groups on $CD4^+$ cell count. Specifically, participants in the intervention condition demonstrated significantly lower $CD4^+$ counts (M = 486, SD = 224.84) compared to the TAU condition (M = 1936.84, SD = 3336.97).

Patient Satisfaction with the Intervention

Means and standard deviations for the participant satisfaction measure were evaluated and compared to the scale anchors to determine if the level of satisfaction with the *Electronic Life Steps* program was relatively high or low. Of the 47 participants in the intervention condition, 85.1% agreed or strongly agreed that they were satisfied with the program and 76.6% reported learning new things from the intervention. Additionally, 80.9% reported that the intervention made them think about their adherence to HIV medications.

Primary Analyses

Between-group differences were evaluated with *t*-tests of group means. A series of repeated measures ANOVA tests were conducted with condition (*eLifeSteps* and Treatment as Usual) as the between-subjects factor and time (baseline and 1-month follow-up) as the within-subjects factor. Dependent variables included self-efficacy, adherence, CD4+ count, and viral load. See Table 3 for baseline and follow-up means and standard deviations for the dependent variables.

Treatment Self-Efficacy

Immediate post-intervention scores on the measure of self-efficacy (HIV-ASES) for treatment adherence were calculated for all participants. Regression imputation was

used to predict self-efficacy scores for participants who were missing data points at one-month follow-up. First, means and regression coefficients were calculated at baseline and included in the regression equation for each condition. Second, the predicted score was calculated and imputed for each participant with missing data at 1-month follow-up. Time × Condition interaction effects in mixed model ANOVAs were examined and demonstrated a significant difference between the two conditions $F(1, 87) = 4.70$, $p = .03$, $\eta^2 = .05$. Between-group differences in self-efficacy were evaluated at the baseline and one-month follow-up time point with *t*-tests of group means. Results failed to reach significance at baseline $t(87) = 1.48$, $p = .14$; however, there was a significant difference in treatment self-efficacy between conditions at 1-month follow- up, $t(89) = 2.50$, $p = .01$, with participants in the *eLifeSteps* condition reporting higher scores of self-efficacy to adhere to their HIV treatment regimen ($M = 8.77$, $SD = 1.34$) compared to the TAU participants ($M = 7.96$, $SD = 1.67$).

Adherence

Adherence scores were calculated for all participants using self-reported 4-day recall data. For those who were missing data points, regression imputation was used to predict scores for that participant's 1-month follow-up data point. Time × Condition interaction effects in mixed model ANOVAs were also evaluated to examine differences in patterns of change in adherence over time between the two groups. Although approaching significance, the interaction term failed to demonstrate a statistically significant difference in the pattern of change in adherence over time, $F(1, 92) = 3.75$, $p = .056$, $\eta^2 = .04$. Between-group differences in adherence were evaluated at baseline and

1-month follow-up with *t*-tests of group means. There was a significant difference in adherence levels between the two conditions at baseline, $t(92) = -2.16$, $p = .03$, with the TAU group ($M = 80.81$, $SD = 26.41$) reporting significantly greater levels of adherence than the *eLifeSteps* group ($M = 67.20$, $SD = 34.29$). Results from the *t*-test at one-month follow-up failed to demonstrate a significant difference between conditions, $t(93) = -0.10$, $p = .92$. These results demonstrated a trend in improved adherence over time among participants in the *eLifeSteps* condition, while participants in the TAU condition remained consistent between baseline and follow-up (see Figure 2 for change in adherence by condition at baseline and follow-up.)

Clinical Outcomes

Differences in viral load and CD4+ cell counts were examined by extracting data from medical records beginning with examining the most recent clinical outcome data at baseline assessment and examining data three months post-baseline assessment. Data points were available and extracted for 85 participants. Last observation carried forward (LOCF) was used to complete the missing data points from baseline to three month follow-up. Between-group differences in CD4+ count and viral load were evaluated at 3-month follow-up with *t*-tests of group means, with no significant differences (all $p>.05$). See Table 5 for means and standard deviations of clinical outcome data.

Time (*Post-intervention and 3-month follow-up*) × Treatment (*TAU, eLifeSteps*) interaction effects in mixed model ANOVAs were also evaluated to examine differences in patterns of change in viral and immunologic outcomes over time between the two groups. Results for CD4+ count were nonsignificant, $F(1, 83) = 2.21$, $p=.14$, $\eta^2=.03$. The

results for viral load also were nonsignifcant, $F(1, 83) = 1.96$, $p=.17$, $\eta^2=.02$; however, it should be noted that a trend was observed in which participants in the *eLifeSteps* group demonstrated a decrease in viral load from baseline ($M = 19959.07$, $SD = 89499.42$) to follow-up ($M = 4425.12$, $SD = 21888.61$) and an increase in viral load for participants in the TAU group from baseline ($M = 3316.19$, $SD = 17267.31$) to follow-up ($M = 7711.16$, $SD = 33154.20$).

CHAPTER IV

DISCUSSION

Nonadherence to prescribed medication regimens among HIV patients is a serious public health concern. Widespread dissemination of current efficacious interventions designed to improve adherence is limited by several practical barriers including additional time and expense burdens in the health care systems. Electronic interventions could overcome these barriers and aid dissemination of an efficacious intervention in the clinic setting. This study provides support that a computer-based HIV adherence intervention is feasible and easily implemented into a busy outpatient medical setting. Participant satisfaction data strongly support the relevance and helpfulness of the program among patients living with HIV. Eighty-five percent of the participants reported being satisfied with the program and approximately 81% indicated that the computer-based intervention made them think about their adherence to their HIV medication regimen.

Additionally, these results demonstrated that participants in the *eLifeSteps* program reported higher self-efficacy to adhere to their HIV medication regimen at 1-

month follow-up compared to the TAU condition. Although levels of adherence were approaching significance, a trend was observed in which participants in the *eLifeSteps*

condition demonstrated an increase in self-reported medication adherence at 1-month follow-up and participants in the TAU condition remained constant. Finally, this study was underpowered to detect significant differences in viral and immunological outcomes. However, it should be noted that trends in the 3-month assessment of CD4 and viral load revealed that participants in the *eLifeSteps* condition reported an improvement in clinical outcomes; whereas, participants in the TAU condition declined.

Several limitations to this study need to be acknowledged. First, this is the initial empirical demonstration of the *eLifeSteps* intervention; therefore replication and extension are required. Second, the relatively short 1-month follow-up period demonstrated improvements in self-efficacy and adherence; however, additional longitudinal follow-up data is needed to determine the length of effects of such an intervention. Third, this study relied on self-reported adherence as the main outcome. Although there is currently no gold standard for assessing medication adherence and the current literature supports the use of the ACTG 4-day recall measure (Chesney et al., 2000), the use of more objective measures of adherence may provide a more valid measurement of adherence. Finally, the intervention sample in this study demonstrated significant differences in baseline CD4 count and levels of adherence with participants in the *eLifeSteps* intervention reporting lower CD4 counts and lower levels of adherence compared to the TAU condition. This suggests that the intervention condition was, overall, more at-risk for nonadherence compared to the TAU condition. Additionally, data for this study was gathered at a federally funded outpatient clinic that primarily serves low income patients with HIV which may limit generalizability of these findings.

The present study is the first to examine a computer-based intervention to promote HIV adherence delivered via a single-session format. The authors identified only one other study that developed and tested the efficacy of a computer-based HIV adherence promotion intervention. Fisher and colleagues (2011) developed a similar intervention that was administered at each of the participant's regularly scheduled HIV care visits over approximately 18 months. This study found that participants who used the computer-based intervention consistently for at least six times demonstrated higher levels of perfect adherence over time; whereas, the control group exhibited a decline in adherence over time. This may indicate that, to achieve statistically significant differences in adherence between the intervention and control groups, multiple administrations of the intervention are required compared to the single-session format presented in this paper.

Unfortunately, implementation of a multi-session program may increase burdens for clinic staff to identify which modules patients need to complete at each visit. The *eLifeSteps* intervention presented in this paper is designed to be completed at only one clinic visit among patients identified as at-risk for nonadherence (e.g., patients newly prescribed a antiretroviral regimen, changing regimens, or report adherence <90%). Participants in this study received a copy of the program on compact disc and were given their user-journal to review the steps when needed. It is important for future studies to examine this single-session format compared to multi-session formats of computer-based interventions to determine which program is more efficacious.

The use of technology-assisted interventions is a convenient, economical solution to the current limitations imposed upon health care providers. This type of intervention requires minimum training and time by clinic staff and can be implemented in clinic waiting rooms. Additionally, this technology has the potential to be used in rural settings that lack access to psychological interventions and may be adapted to be used with a wide array of chronic illnesses requiring stringent medication adherence. Developing electronic interventions based on currently existing empirically supported interventions may help alleviate the gap between patient nonadherence and the barriers that limit practitioners from delivering comprehensive, multifaceted effective interventions aimed at increasing adherence. Adapting efficacious programs for HIV medication adherence, such as the *Life Steps* intervention, may be an effective technology-assisted adherence promotion tool.

Table 1 *eLifeSteps* Intervention Modules

Module	Description
Step 1: Education & Introduction	Information about the role medication adherence plays in successful treatment is provided. The aim is to increase knowledge and self-efficacy to influence treatment success and introduce problem-solving for medication adherence.
Step 2: Transportation to Appointments	Problem-solving strategies, brief cognitive restructuring, and rehearsal techniques are provided to address transportation issues to prevent missed appointments with health care providers
Step 3: Obtaining Medications	Patients develop a plan for continued access to medications. Concerns regarding patient's privacy and confidentiality during interactions with the pharmacist are addressed.
Step 4: Communicating with Health Care Providers	Brief cognitive techniques are suggested for irrational fears about asking questions.
Step 5: Coping with Side-Effects	In this module patients are asked to (a) help themselves pick a regimen collaboratively with their doctor to minimize side effects; (b) re-interpret the initial side effects as signs that the medications are in their bloodstream and working; and (c) increase the salience of the reasons for taking medications despite the side effects.
Step 6: Formulating a Daily Medication Schedule	Patients complete a detailed map of an average day of pill-taking, specifying environmental and other cues for pill-taking throughout the day.
Step 7: Storing Medications	Problem-solving techniques are presented to address storing medications when patients are not at home.
Step 8: Cues for Pill-Taking	The patient is provided with a set of colored adhesive dots which are used to cue pill taking by placing the dots in various spots where the patient will see them. Adaptive cognitions for adherence are rehearsed and overt reminders (e.g., setting alarms) for adherence are discussed.
Step 9: Response to Slips in Adherence	Patients are taught how to handle slips and to avoid all-or-nothing thoughts. Cognitive techniques to cope with a lapse are discussed.
Step 10: Review	This module reviews the previous steps via an imbedded quiz and provides patients feedback regarding any questions answered incorrectly.

Table 2 Sample characteristics[a]

	Control (*N*=50)	Intervention (*N*=47)	Total (*N*=97)
Age (years)	42 (9.47)	43.7 (10.19)	44 (9.82)
Gender			
Male	42 (84%)	38 (80.9%)	80 (82.5%)
Female	7 (14%)	9 (19.1%)	16 (16.5%)
Race/ethnicity			
African-American	10 (20%)	11 (23.4%)	21 (21.6%)
American Indian	7 (14%)	5 (10.6%)	12 (12.4%)
Caucasian	29 (58%)	29 (61.7%)	58 (59.8%)
Other	2 (4%)	2 (4.2%)	4 (4.1%)
Sexual orientation			
Bisexual	2 (4%)	5 (11.6%)	7 (7.3%)
Heterosexual	15 (30%)	15 (34.9%)	30 (31.3%)
Homosexual	29 (58%)	20 (46.5%)	49 (51%)
Education			
Graduated High School	11 (22%)	14 (29.8%)	25 (25.8%)
Some College	23 (46%)	20 (42.6%)	43 (44.3%)
Graduated College	9 (18%)	7 (14.9%)	16 (16.5%)
Other	6 (12%)	6 (12.7%)	12 (12.3%)
Means of HIV Transmission			
Sex with a HIV+ man	34 (68%)	34 (72.3%)	68 (70.1%)
Sex with a HIV+ woman	5 (10%)	8 (17%)	13 (13.4%)
Shared needles	3 (6%)	5 (10.6%)	8 (8.2%)
Blood transfusion	4 (8%)	2 (4.3%)	6 (6.2%)
Does not know	3 (6%)	2 (4.3%)	5 (5.2%)
Baseline adherence[b]			
100% adherence	24 (48%)	17 (36.2%)	41 (42.3%)
≥90% adherence	1 (2%)	0 (0%)	1 (1%)
≥75% adherence	13 (26%)	12 (25.5%)	25 (25.7%)
<75% adherence	9 (18%)	18 (38.3%)	27 (27.7%)
Follow-up adherence[b] (1 mos)			
100% adherence	22 (44%)	19 (40.4%)	41 (42.3%)
≥90% adherence	0 (0%)	6 (12.8%)	6 (6.2%)
≥75% adherence	17 (34%)	10 (21.3%)	27 (27.9%)
<75% adherence	9 (18%)	12 (25.7%)	21 (21.6%)

[a] Data are means (SD) or numbers (%)

[b] Self-reported 4-day recall

Table 3
Treatment outcome as a function of group

	Baseline	Follow-up
Outcome measure and group	*M* (SD)	*M* (SD)
Treatment self-efficacy		
eLifeSteps	8.46 (1.77)	8.79 (1.34)
TAU	7.88 (1.90)	7.98 (1.67)
Adherence (%)		
eLifeSteps	67.20 (34.29)	80.53 (26.29)
TAU	80.81 (26.41)	81.40 (25.21)
CD4+ count		
eLifeSteps	486 (224.84)	507.51 (242.08)
TAU	593.14 (299.29)	638.77 (499.64)
Viral Load		
eLifeSteps	19959.07 (89499.42)	4425.12 (21888.61)
TAU	3316.19 (17267.31)	7711.16 (33154.20)

Table 4

Comparison of completers and drop-outs on demographic variables and self-report measures

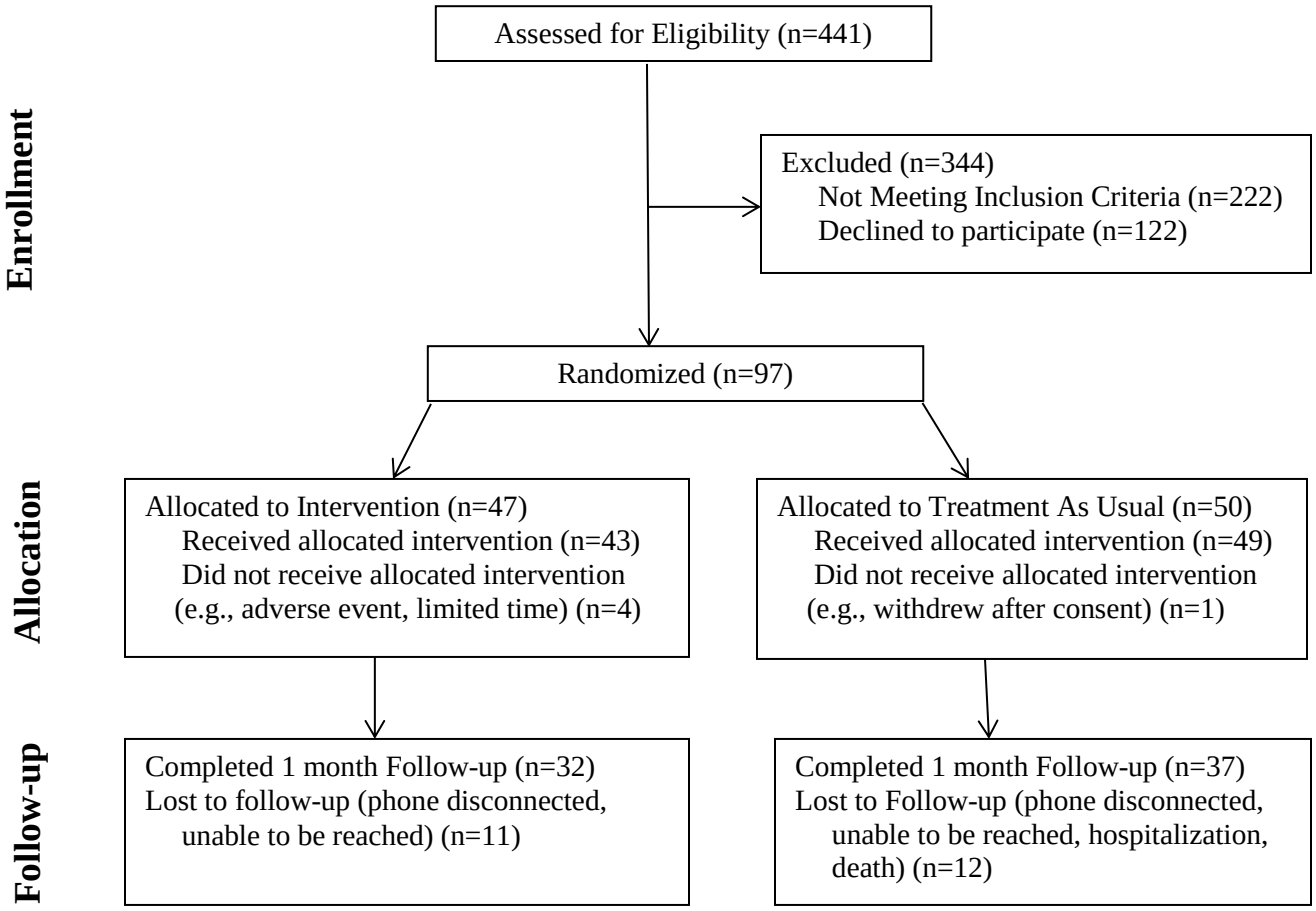
Variables	Completers (N = 74)		Drop-outs (N = 23)			
	M	*SD*	*M*	*SD*	t/χ^2	*p*
Sex					0.19	.66
Male (%)	82.4		86.4			
Age	42.46	9.98	44.23	9.38	31.83	.62
Ethnicity (%)					6.48	.17
Caucasian	64.9		43.5			
African-American	21.6		21.7			
American Indian	8.1		26.1			
Other	4.1		4.3			
Education (%)					6.95	.33
Graduated High School	25.7		26.1			
Some College	47.3		34.8			
Graduated College	17.6		13			
Other	9.6		21.7			
Housing Status (%)					4.85	.44
Your house/apt	56.8		56.5			
Someone else's house/apt	35.1		26.1			
Institution <30 days	1.4		0			
Transitional Housing	5.4		4.3			
Other	1.4		8.6			
Sexual Orientation (%)					1.12	.77
Bisexual	8.1		4.3			
Gay	51.4		60.9			
Heterosexual	33.8		26.1			
Prefer not to respond	6.8		4.3			
CD4 cell count	555.7	263.49	460.73	285.09	-1.49	.14
Viral load	11491.93	68073.16	6400.57	28002.00	.13	.90
Adherence	74.34	31.36	72.81	31.39	.20	.84

Self-efficacy	8.19	1.86	7.93	1.88	.52	.60

Table 5
Clinical outcome data as a function of group

Clinical outcome measure and group	eLifeSteps		TAU			
	M	*SD*	*M*	*SD*	*t*	*p*
CD4+ cell count						
Baseline	486	224.84	593.14	299.29	-1.87	.07
3 Month follow-up	507.51	242.08	638.77	499.64	-1.55	.12
Viral Load						
Baseline	19959.07	89499.42	638.77	499.64	1.18	.24
3 Month follow-up	4425.11	21888.61	7711.16	33154.20	-.54	.59

Figure 1 Clinical Trial Flow Diagram



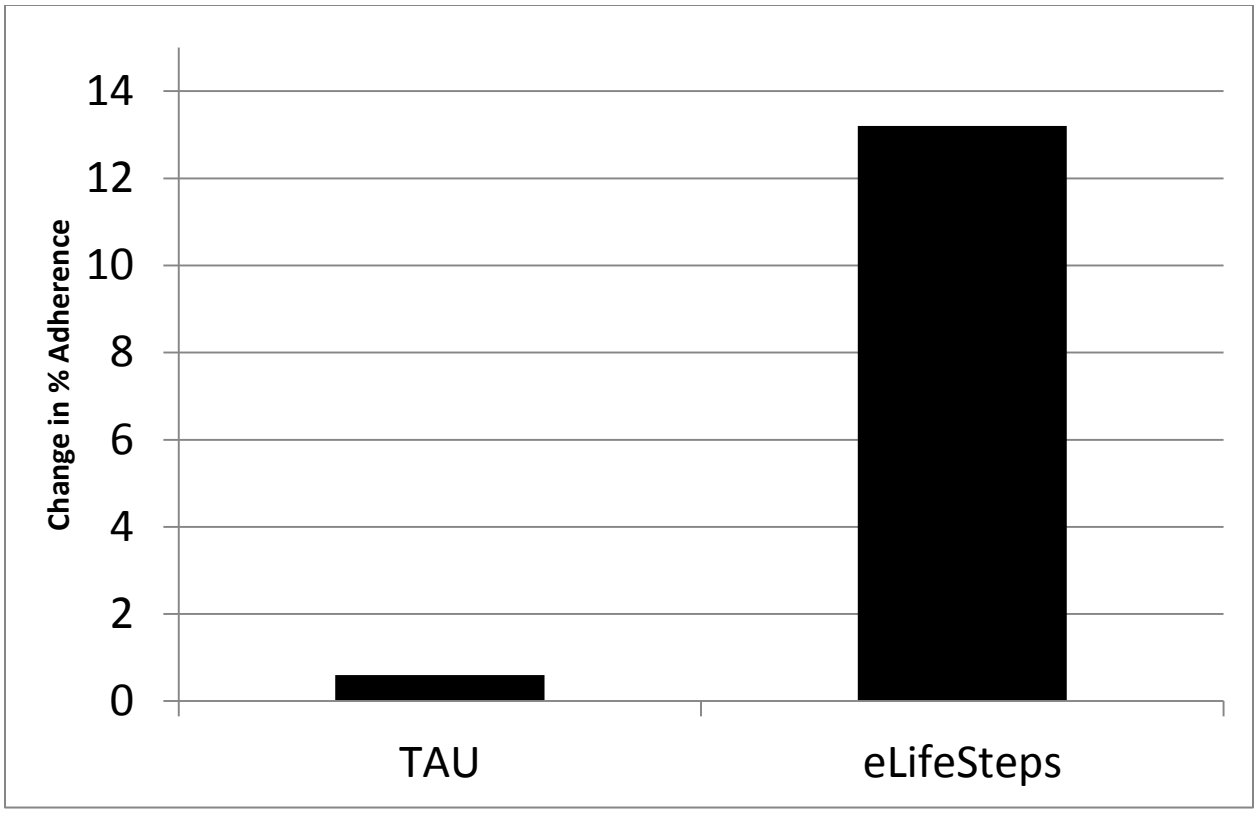


Figure 2 Change in adherence by condition at Baseline and Follow-up

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APPPENDIX A
Proposal Manuscript

INTRODUCTION

Epidemiology of Adherence to HIV Medications

Nonadherence to prescribed medication regimens among HIV patients is a serious public health concern. Unlike most other chronic illnesses, effective HIV treatment requires a stringent adherence rate of 95% or better to maximize the chances of treatment success and improve clinical outcomes. Rates of non-adherence range from 31-70% among patients with HIV and tend to decline over time (Ickovics et al., 2002; Johnson, et al., 2003; Paterson et al., 2000). Consistent, long-term adherence is essential for optimal clinical outcomes and improved quality of life (H. Wang et al., 2009). Individuals with inadequate adherence are at risk for disease progression, development of drug resistance, and mortality. More specifically, people with HIV who adhere to their regimens 70-90% of the time present the greatest risk for virological failure, immunologic failure, and development of treatment resistant strains of HIV (Lucas, 2005).

Drug resistance is a major concern for patients currently taking HIV medications due to the possibility of developing a superinfection which is a result of being infected with multiple strains of the virus, some of which may be treatment resistant. Additionally, treatment resistance is a concern for patients who are newly infected with the virus and for those who are initiating medication treatment (Klimas, Koneru, & Fletcher, 2008). The presence of drug resistant mutations presents a serious public health concern in the prevention and control of HIV. Transmission of drug resistant strains leaves patients with minimal treatment options once the virus progresses to a stage in which treatment is warranted. These patients may continue anti-HIV medication therapy and receive some clinical benefits; however, the virus will likely continue to replicate (Lucas, 2005). In order for patients to have the least risk of developing

treatment resistant strains of the virus, a 95% or greater rate of adherence to HIV medication regimens is necessary.

Unfortunately, multiple factors pose significant problems to maintaining a very high rate of adherence long-term. The medication regimens are complex and often result in many side effects (Paterson, et al., 2000). Highly Active Antiretroviral Therapy (HAART) is the recommended treatment for HIV and requires a combination of drugs belonging to two classes of antiretroviral agents (Klimas, et al., 2008). Medication regimens are individually tailored to the patient, therefore the number of pills and how often the patient is required to take the medication varies. Most regimens require multiple pills throughout the day in which some must be taken on an empty stomach, while others must be taken with meals or before or after doses of other medications. This complex regimen poses multiple barriers to adherence and many challenges for people taking antiretroviral medications.

In addition to the complex regimen, numerous biological, behavioral, and social factors influence medication adherence. Biological factors include disease status, host immunology, genetics, and characteristics of the medications, including drug potency and pharmacology (Friedland, 2006). The most reported deterrents of adherence among patients is adverse side effects of the regimen, the large number of pills, and dosing restrictions (i.e., frequency and if they require food or water). Behavioral factors, which often lie at the root of treatment failure, include accurate knowledge regarding the regimen, cognitive functioning (i.e., remembering the regimen and having the capacity to understand dosing requirements), motivation, and skills (Friedland, 2006). Many patients report failing to remember to take the medications, especially when they are not at home, being uncertain about how to take the medications, and believing that

they cannot adhere to the strict regimen requirements (Kathleen Johnston Roberts, 2000). Social factors such as availability of resources, access to care and treatment, race, gender, and stigma play an important role in adherence as well (Friedland, 2006). Implementing the medication regimen into daily life and being unable to take medications privately while at work or in public pose a significant barrier to patients. It is imperative that health care providers address these issues with patients, particularly those beginning a new regimen or who are nonadherent.

Medication adherence has been a primary concern among health care providers since the inception of antiretroviral medications. Due to the strict adherence rate, the proportion of individuals with HIV who maintain optimal level of adherence is relatively small. Multiple studies have found that as many as 50% of patients do not meet adherence requirements (A. Ammassari et al., 2001; David R. Bangsberg et al., 2003; Ickovics, et al., 2002). Other studies have found that only 4-30% of HIV patients were able to achieve a 95% adherence rate (Golin et al., 2002; Paterson, et al., 2000). Nonadherence to prescribed antiretroviral medications may result in failure to achieve viral suppression, increased HIV replication, and can lead to the development and transmission of drug resistant strains of HIV. Consequently, health care providers are increasingly providing patients assistance with medication adherence to reduce the chances of treatment failure and decrease development of drug resistant strains being transmitted to the public (Smith, et al., 2004).

Currently, no gold standard exists for assessing medication adherence among health care providers and the methods for assessment vary. Some providers may assess adherence every visit; whereas, others may assess adherence only with patients who are at-risk for nonadherence or who demonstrate treatment regimen failure via virologic failure (i.e., HIV is detected in the

blood 48 weeks after treatment initiation), immunologic failure (i.e., CD4 cells decrease in number), or clinical progression of HIV. Further, health care providers often lack sufficient time, education and resources to adequately prepare patients beginning treatment regimens to increase rates of adherence (Gerbert, Bronstone, Clanon, Abercrombie, & Bangsberg, 2000). Due to the variety of frequency and methods of assessment and intervention, research should focus on establishing a standardized intervention that offers education regarding antiretroviral medications, enhances motivation to maintain adequate adherence, and provides problem-solving skills to enhance rates of adherence prior to initiation of treatment regimens. An electronic computer-based intervention would provide a standardized method of assessment and intervention which would greatly assist health care providers who currently have limited time constraints and resources to provide such an intervention.

Interventions Designed to Improve Medication Adherence

Recent developments in intervention have found targeted intervention efforts using cognitive behavior therapy and motivational interviewing techniques to be effective at increasing adherence rates among patients with HIV (Parsons, Golub, Rosof, & Holder, 2007). The effects of these interventions have proven superior to the long-standing educational and self-monitoring approaches (Julius, Novitsky, & Dubin, 2009). Although the development of effective interventions is a promising step, several practical barriers limit the likelihood of widespread dissemination and adoption of these methods. Intervention approaches that are delivered by clinical staff place additional time and expense burdens on health care systems and professionals that are already under heavy demands of patient care. To provide ideal interventions with fidelity to evidence-based approaches, additional burdens of training and supervision are necessary.

The Present Study

An electronic, computer-based intervention could overcome several barriers and aid dissemination of an efficacious, cost-effective, and high-fidelity intervention in the clinic setting. Therefore, the present study was designed to develop an innovative computer-based electronic adaptation of an evidenced-based program to enhance medication adherence among individuals with HIV and evaluate the efficacy of the electronic intervention via a randomized controlled trial. The development of a brief, computerized intervention targeting medication adherence may reduce the already demanding time constraints placed on physicians and health care providers. Further, this intervention will be economically feasible and cost-effective and easily disseminated among patients who are at-risk for nonadherence, particularly patients who are initiating treatment, changing regimens, or demonstrated previous failures to adhere to the regimen.

A REVIEW OF THE LITERATURE

The introduction of Acquired Immune Deficiency Syndrome (AIDS) in 1981 initiated a global pandemic that has resulted in a plethora of worldwide problems including premature death, debilitating health concerns, financial hardship both on the micro and macro economy, and a deepening of socioeconomic and gender disparities (Pence et al., 2008; Sohler, Li, & Cunningham, 2009; Tsai, Chopra, Pronyk, & Martinson, 2009). Within the last three decades, over 25 million people worldwide have died as a result of the disease (Merson, 2006). The amount of people living with human immunodeficiency virus (HIV), which causes AIDS, has more than tripled since 1990, with an estimated 33.4 million people currently living with HIV worldwide (UNAIDS/WHO, 2009). In the United States, it was estimated that more than 1.1 million adults and adolescents were living with HIV infection in 2006 and approximately 56,000 people are infected annually (Hall et al., 2008). It is expected that if the HIV transmission rate in the United States remains constant, within the next decade, the number of new infections will increase to more than 75,000 annually. This data has resulted in a renewed urgency to combat the HIV epidemic in the United States by reducing the number of new infections, increasing access to care, and reducing HIV-related health disparities (see *National HIV/AIDS Strategy for the United States*, 2010). Epidemiological data also suggests that the spread of HIV peaked after the introduction of antiretroviral medication in 1996, yet it continues to remain at a disturbingly high level.

Pharmacological treatment advances have drastically reduced HIV-related morbidity and mortality. The inception of highly active antiretroviral therapy (HAART) shifted HIV/AIDS from an acute, terminal disease to a chronic illness by extending the survival period. This

treatment has been shown to suppress viral replication, preserve immune functioning, maintain or improve quality of life, and reduce HIV-related morbidity and mortality (Blalock & Campos, 2003; Rathbun, Lockhart, & Stephens, 2006; H. Wang, et al., 2009). Once treatment is initiated, it is expected that treatment will be lifelong. HAART regimens have been notoriously harsh and complex, requiring a combination of three or more drugs belonging to two classes of antiretroviral agents (Blalock & Campos, 2003; Rathbun, et al., 2006). Medication regimens are individually tailored to the patient, therefore the number of pills and frequency of dosage the patient is required to take the medication varies. Most regimens require multiple pills throughout the day in which some must be taken on an empty stomach, while others must be taken with meals or before or after doses of other medications.

Fortunately, pharmacological advances have yielded newer drugs with longer half-lives generating once-daily regimens which simplify the dosing schedule and has the potential for increased adherence. Disadvantages inherent with the once-daily regimen include poorer tolerability with higher doses and potential for increased development of treatment resistance in patients who do not adequately adhere to the regimen (Rathbun, et al., 2006). Patients may find it difficult to tolerate HIV medications due to a number of negative side effects and drug toxicities, some of which may be serious and potentially life-threatening such as Hepatotoxicity, hyperglycemia, high cholesterol, and Hyperlipidemia which can lead to heart disease and pancreatitis. Other side effects may not be potentially life-threatening, however, these symptoms may be very difficult to tolerate and may include neurocognitive deficits, psychiatric side effects, abnormal fat distribution, decreased bone density, skin rash, nerve problems, increased bleeding, nausea, and headaches (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2009).

Although HAART is generally associated with improved quality of life, these negative side effects reduce quality of life, especially in patients who currently do not experience symptoms of HIV or AIDS (Paterson, et al., 2000). Patients may decide that the costs of antiretroviral therapy outweigh the benefits of treatment and may choose to delay therapy or not adhere to the prescribed regimen. Complex regimens and negative side effects pose multiple barriers to adherence and many challenges for people taking antiretroviral medications.

Adherence to Prescribed HIV Treatment Regimens

Adherence refers to the "extent to which a patient's behavior coincides with medical or prescribed health advice" (Julius, et al., 2009, p. 34). Behaviors of nonadherence may include premature termination of therapeutic regimen, inaccurate use of medications, taking drug holidays, using treatments or substances not prescribed, and failure to attend medical appointments (Cox, 2009). Unlike many other chronic illnesses which require an adherence rate around 80% for adequate control, effective HIV treatment requires a stringent adherence rate of 95% or better to optimize the chances of treatment success and reduce the likelihood of developing drug resistant strains of HIV. Rates of adherence to HIV regimens is closely associated with viral suppression, development of drug resistant strains, clinical disease progression, and mortality (D. R. Bangsberg et al., 2000; D. R. Bangsberg et al., 2001; García de Olalla et al., 2002; Hogg et al., 2002; Paterson, et al., 2000). Antiretroviral treatment adherence rates of 70%-80% have been associated with high rates of treatment regimen failure and emergence of resistant strains of the virus, suggesting that partial adherence may be more detrimental than discontinuation of the treatment regimen (Paterson, et al., 2000). Conversely,

consistent adherence has been associated with health, economic, and psychosocial benefits worldwide.

Numerous studies have demonstrated improved immunological responses and viral suppression among patients who adhere to antiretroviral medications. Wang and colleagues (2009) examined the relationship of adherence to HAART medications and treatment outcomes measured via CD4 cell counts and occurrence of HIV/AIDS-related opportunistic infections. Among this sample, the most common reasons for missing doses or discontinuing treatment prematurely included: (1) forgetting medication; (2) being away from home; (3) being too busy; and (4) negative side effects from the regimen. Participants were dichotomized as either consistent adherers or nonadherers. The results demonstrated that participants who adhered to their prescribed regimen had greater CD4 cell growth, which is indicative of immunologic recovery, and were significantly more likely to be free from opportunistic infections compared to nonadherent participants.

Additionally, adherence has been associated with suppression of viral loads below limits of detection, slowing progression of HIV and delaying the development of AIDS. In a double-blind, randomized controlled trial conducted across four countries, among individuals who maintained 90% or better adherence, no participants progressed to AIDS status during the study period; however, among participants who were less than 50% adherent, 8% progressed to AIDS during the study period. Among participants with rates of adherence between 51-89%, 38% progressed to AIDS (Montaner et al., 1998). More recent studies have demonstrated similar results and have further shown that the stringent adherence cut-off of 95% is necessary for good response to treatment; individuals below this level are more likely to experience poorer

virological and immunological responses to treatment and are at an increased risk of developing drug resistance to two or more drugs (Kitahata et al., 2004; Lima et al., 2008). Individuals with low rates of adherence are over five times more likely to experience disease progression than moderate- and high-adherers (Kitahata, et al., 2004). The progression from HIV status to AIDS greatly contributes to increased morbidity and mortality.

Since its inception, HAART has greatly reduced the number of deaths due to HIV/AIDS. Multiple randomized controlled trials in patients who currently meet an AIDS diagnosis or have a history of an AIDS-defining illness (indicated by CD4 cell counts <200 cells/mm^3) provide strong support that antiretroviral regimens improve survival and delay disease progression ("Zidovudine, didanosine, and zalcitabine in the treatment of HIV infection: meta-analyses of the randomised evidence. HIV Trialists' Collaborative Group," 1999; Zolopa et al., 2009). Early initiation of treatment may prevent damage to organs and neurocognitive decline associated with viral replication during early stages of treatment (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2009). However, the potential benefit of reduced mortality is contingent on long-term adherence to antiretroviral medications. Individuals who adhere at the beginning of HIV treatment initiation have a longer life expectancy than those who do not adhere or receive no treatment (Aracena-Genao, Navarro, Lamadrid-Figueroa, Forsythe, & Trejo-Valdivia, 2008). Further, patients who are non-adherent are almost 4 times more likely to die than an adherent patient on the same therapeutic regimen (García de Olalla, et al., 2002). HIV positive individuals with better immunological responses, fewer opportunistic infections, and longer life expectancy require fewer medical resources throughout their life span and place less of a burden on medical professionals.

Antiretroviral medications are expensive and some patients choose to skip dosings in order to assuage the economic burden. Unfortunately, this strategy may inevitably result in additional unanticipated hospital expenses. Adherence to HAART has been associated with lower hospital expenses, shorter hospital stays, and decreased hospital readmissions (H. Wang, et al., 2009). Cost-effectiveness analyses have indicated that the cost of antiretroviral medications may be offset by decreased hospitalization costs and slower disease progression which also enables the patient to continue working and living a productive life (Nosyk, Sun, Li, Palepu, & Anis, 2006). Wang and colleagues (2009) found an association between consistent high levels of adherence and reduced utilization of medical resources (e.g., decreased number of nontrauma hospitalizations, reduced hospital expenses). Increased risk of compromised health due to immunodeficiency caused by HIV likely diminishes quality of life among patients.

Consistent adherence to HIV regimens has been found to be the most important factor in improving quality of life among patients (H. Wang, et al., 2009). Patients who are adherent have demonstrated better physical health outcomes and physical functioning, greater vitality, better social functioning and mental health compared to patients who do not adhere (H. Wang, et al., 2009). However, the relationship between adherence and quality of life is reciprocal and quite complex. Patients who are asymptomatic may see a reduction in their quality of life with early initiation of HAART (Low-Beer et al., 2000; Nieuwkerk et al., 2001; Zinkernagel et al., 1999). Negative side effects and drug toxicities associated with drug regimens can be difficult to tolerate and may result in insufficient rates of adherence or premature termination of treatment. Additionally, patients must adhere to strict regimen protocols that may require rigid time schedules, dietary prescriptions, and multiple pills which may be taxing on the individual.

However, with the improvement of antiretroviral medications, side effects have become more tolerable and regimens more simplistic.

More recent studies have found long-term improvements in quality of life among both symptomatic and asymptomatic patients (S. B. Mannheimer et al., 2005). Mannheimer and colleagues (2005) conducted a longitudinal study which demonstrated improvements in quality of life over time in HIV patients prescribed antiretroviral therapy. The results indicated significant improvements in physical components as early as one month after initiation of HAART and improvements in mental functioning after four months with improvements being sustained over the course of one year. Participants reporting 100% adherence had the greatest gains in both physical and mental functioning at all four follow-up points (month 1, 4, 8, and 12); whereas, participants reporting 80-99% adherence had smaller gains and participants reporting less than 80% adherence displayed lower levels of quality of life at follow-up compared to their baseline scores. This demonstrates the importance of maintaining near perfect levels of adherence and the benefits HIV treatment can have on quality of life. Nonadherence to antiretroviral regimens is an important predictor for losing the long-term clinical and economic benefits of treatment.

The Problem of Nonadherence to HIV Treatment

The proportion of individuals with HIV who maintain an optimal level of adherence is relatively small. Multiple studies have found that as many as 50% of patients do not meet adherence requirements (Adriana Ammassari et al., 2002; Gardner, Burman, Maravi, & Davidson, 2006; Ickovics, et al., 2002). Other studies have found that only 4-31% of HIV patients were able to achieve a 95% adherence rate (Golin, et al., 2002; Paterson, et al., 2000).

Further, rates of non-adherence tend to decline over time and with subsequent regimens (Gardner, et al., 2006; Ickovics, et al., 2002; Johnson, et al., 2003; Paterson, et al., 2000).

Gardner and colleagues (2006) examined the durability of patient adherence to HAART regimens by evaluating changes in adherence throughout the course of an initial treatment regimen and then examining adherence over successive regimens. Results demonstrated that adherence was closely associated with initial regimen duration; however, adherence tended to decrease throughout the course of the initial regimen and trended downward with subsequent regimens. These results provide support that adherence to antiretroviral medications tends to decrease over time, even among patients who are very adherent. Additional studies have indicated that poor adherence early in treatment is among the most common reason for discontinuing HAART treatment and experiencing treatment failure (d'Arminio Monforte et al., 2000; Mocroft et al., 2001; Moss et al., 2004). This downward trend in adherence has been termed "adherence fatigue" and demonstrates the need for effective interventions in strengthening medication adherence not only for patients initiating antiretroviral therapy, but throughout the course of treatment as well.

As HIV medications have become more simplistic and advanced, leading to a decrease in toxicity and negative side effects, discontinuation of therapeutic regimens due to intolerance and toxicity has declined over time; however, intolerance and toxicity remain the major cause of HIV regimen discontinuation (Cicconi et al., 2010). Cicconi and colleagues (2010) investigated reasons for first-line treatment discontinuation among patients initiating HAART regimens during the early stages of HAART beginning in 1997 to more recent HAART regimens ending in 2007. The results demonstrated that intolerance/toxicity and poor adherence were the main

causes of treatment discontinuation during the first 12 months of treatment. Interestingly, modification of initial medication regimens due to poor adherence did not change across time even though more recent regimens have a lower pill burden. The authors suggested this was likely a result of little change in the attitude towards antiretroviral therapy across time. Further, patients with a history of injection drug abuse and patients younger than age 30 had a tendency towards higher rates of discontinuation due to poor adherence. These results reflect the impact stigma and negative attitude towards HIV medications have on adherence and expand on the existing literature which has revealed specific factors associated with heightened risk for poor adherence.

Barriers to Adherence

Numerous biological, behavioral, and social factors influence medication adherence. Biological factors include disease status, host immunology, genetics, and characteristics of the medications, including drug potency and pharmacology (Friedland, 2006). Patients who are asymptomatic have a higher rate of nonadherence than patients where the disease is more advanced and may have progressed to AIDS status. Individuals who experience symptoms of HIV/AIDS perceive nonadherence to HIV regimens as a higher risk for complications from HIV (Gao, Nau, Rosenbluth, Scott, & Woodward, 2000). The most reported deterrents of adherence among patients is adverse side effects of the regimen, the number of pills, and dosing restrictions (i.e., frequency and if they require food or water). Extensive toxicity and side effects associated with HAART may greatly influence a patient's willingness to adhere to the regimen. Both transient (diarrhea, nausea) and long-lasting (Lipodystrophy, neuropathy) side effects account for more regimen changes than does treatment failure (M. Chesney, 2004; d'Arminio Monforte, et

al., 2000; Mocroft, et al., 2001). Further, pharmacological characteristics of the prescribed medication play an important role in adherence. The more recently developed once-daily regimens are better tolerated, more flexible, and more forgiving if patients miss a dose. Several of these medications have long elimination half-lives (between 24-50 hours) which mitigate the increased risk of viral rebound and development of drug resistance when a patient misses a dose (Conway, 2007). Medication regimens that are simplistic and best conform to the patient's lifestyle and schedule may predict better adherence.

Behavioral factors, which often lie at the root of treatment failure, include accurate knowledge regarding the regimen, cognitive functioning (i.e., remembering the regimen and having the capacity to understand dosing requirements), psychological functioning (i.e., depression, stress, feeling hopeless), motivation, and skills (*Adherence to Long-Term Therapies: Evidence for Action*, 2003; Friedland, 2006). Forgetting to take medication is the most frequently cited reason for nonadherence (M. A. Chesney et al., 2000). Many patients report failing to remember to take the medications when they are not at home, being uncertain about how to take the medications, and believing that they cannot adhere to the strict regimen requirements (Kathleen Johnston Roberts, 2000). Further, difficulty understanding the medication regimen hinders adherence as well. Approximately 25% of patients admit to not understanding how to follow their regimens and report confusion over pill number and sequencing (Catz, Kelly, Bogart, Benotsch, & McAuliffe, 2000; M. A. Chesney, et al., 2000). Adequate cognitive functioning and psychosocial issues often contribute to the ability to understand the regimen requirements and adherence.

Lower levels of adherence to HIV regimens have been associated with cognitive deficits in executive functioning tasks which require attention, mental flexibility, and reasoning skills (Albert et al., 1999; Charles H. Hinkin et al., 2004). Additional impairments associated with adherence include memory, attention, and psychomotor speed (Albert, et al., 1999; C. H. Hinkin et al., 2002; Waldrop-Valverde et al., 2006). One of the stronger predictors of nonadherence is impaired cognitive functioning due to active alcohol and substance use. Recreational drug and alcohol use have consistently been associated with poor levels of adherence (Halkitis, Shrem, Zade, & Wilton, 2005; Mugavero et al., 2006; Murphy, Roberts, Martin, Marelich, & Hoffman, 2000; Rothlind et al., 2005; Waldrop-Valverde, et al., 2006; Witteveen & van Ameijden, 2002). Ingesting substances that result in temporary cognitive impairments can cause missed doses and combining certain illicit drugs with antiretroviral medications can produce unwanted negative side effects and may also strain the liver or lead to possible overdose (Halkitis, et al., 2005). In order to avoid these negative consequences, individuals may take their antiretroviral medications during the week and discontinue their use on weekends to drink alcohol or use other substances. These lapses in adherence, often referred to as "drug holidays", may contribute to the development of viral resistance and more rapid disease progression. Individuals with HIV who also abuse substances are at a heightened risk for nonadherence due to acute and potentially chronic cognitive impairment, mental health functioning, and educational challenges frequently experienced among this population.

As demonstrated among the substance abusing population, the HIV pandemic has widened the gap of socioeconomic disparities. AIDS has disproportionately affected the lower socioeconomic strata which include intravenous drug users, homeless, prostitutes, and

individuals living in poverty. Among this population, poor education and low rates of reading literacy have posed many challenges to HIV medication adherence. Kalichman and colleagues (1999, 2000) were among the first to investigate the ability of patients with HIV to comprehend medical information and the association between literacy skills and adherence to medication regimens. The authors found that HIV patients with limited literacy had less general knowledge of HIV and their treatment regimen compared to patients with adequate literacy skills. Further, these patients reported significantly worse biological outcomes as evidenced by lower CD4 cell counts and being less likely to have an undetectable viral load (S. C. Kalichman et al., 2000; S. C. Kalichman, Ramachandran, & Catz, 1999). Patient literacy level has been associated with more than a three-fold greater likelihood of missing doses (Wolf et al., 2007). Additionally, evidence suggests that self-efficacy may mediate the effect of literacy on adherence (Wolf, et al., 2007). It appears that the patient's belief about whether he or she can successfully execute the prescribed medication regimen may play a stronger role in improving medication adherence than only providing knowledge of HIV and the treatment.

In addition to cognitive functioning and substance abuse, other psychosocial issues have been associated with nonadherence, including depression, stress, hopelessness, anxiety, and social support. Depression and stress are among the most significant predictors of adherence (M. Chesney, 2004). Among people living with HIV, approximately 37% meet criteria for a depressive mood disorder (Asch et al., 2003; Bing et al., 2001). Depression has been associated with regression of HIV-related biological outcomes, progression to AIDS status, higher levels of substance use, and mortality (Ironson et al., 2005; Jane Leserman, 2008; Jane Leserman, Ironson, O'Cleirigh, Fordiani, & Balbin, 2008; J. Leserman et al., 2002; Patterson, Shaw, Semple, &

Cherner, 1996). Further, stressful life events have been associated with poorer adherence (Adriana Ammassari, et al., 2002; Catz, et al., 2000). People living with HIV may experience high levels of stress, which lead to a cyclical pattern of decreased adherence to medication, which results in additional stress. Having a strong social support system may buffer against some of the negative effects of increased stress associated with HIV and provide the patient emotional support to increase motivation to adhere to their medication regimen. Lack of social support has been identified as an important risk factor for nonadherence (Adriana Ammassari, et al., 2002).

Social factors such as availability of resources, access to care and treatment, race, gender, and stigma play an important role in adherence as well (Friedland, 2006). Implementing the medication regimen into daily life and being unable to take medications privately while at work or in public pose a significant barrier to patients. Concerns about confidentiality and stigmatization may hinder adherence and therapeutic success. Women, in particular, are often very secretive about their HIV status and reluctant to take their medications that may disclose their HIV status due to fear of rejection and stigmatization (Carr & Gramling, 2004). It is imperative that health care providers address these issues with patients, particularly those beginning a new regimen or who are nonadherent.

Consequences of Nonadherence

Antiretroviral medications have proven to be highly effective in reducing viral replication, improving clinical outcome, and decreasing mortality (M. Chesney, 2004). Failure to adequately adhere to medication regimens places patients at a heightened risk of treatment failure and development of drug resistance. The most common cause for failure to achieve or

maintain expected immunologic and clinical benefits from treatment is failure to adequately adhere to antiretroviral regimens (Conway, 2007). There are three types of treatment failure in HIV: (1) virologic failure; (2) immunological failure; and (3) clinical progression. Virologic failure occurs when antiretroviral medications fail to reduce the amount of HIV in the blood. Viral load indicates the amount of HIV in a sample of blood and is the most important indicator of how well a medication regimen is working. If a patient's viral load fails to decrease or repeatedly rises after having decreased, virologic failure has occurred.

Inadequate adherence may also result in immunologic failure as indicated by decreased CD4 cell count. CD4 cells play a vital role in the immune response by signaling other cells to execute their functions. A healthy person has a CD4 count of 800-1200 per cubic millimeter (mm^3) of blood (Klimas, et al., 2008). As HIV progresses, it destroys CD4 cells and develops holes in the immune repertoire, decreasing immunologic functioning. When CD4 cell counts fall below 200 cells/mm^3 vulnerability to serious opportunistic infections and cancers increase, signaling that the immune system is not responding to antiretroviral medications and clinical progression is imminent. Clinical progression occurs with the presence or recurrence of HIV-related events despite at least 3 months of antiretroviral therapy (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2009). Virologic failure, immunologic failure, and clinical progression may occur independently or concurrently; however, virological failure often occurs first, followed by immunological failure, then clinical progression. Treatment failure may happen over the course of months to years (d'Arminio Monforte, et al., 2000).

In addition to treatment failure, inadequate adherence may result in the development of treatment resistance. Treatment resistance develops when viral replication occurs in the presence

of suboptimal drug concentrations. HIV can rapidly mutate to develop resistant strands of the virus and can result in resistance for an entire class of antiretroviral medications, which, consequently, causes HAART to be ineffective and limits future treatment options (Conway, 2007; Seth C. Kalichman & Malow, 2004).

The transmission of treatment resistant strains of HIV is a serious public health concern in the prevention and control of HIV. Since the inception of HAART, prevalence rates of transmitted drug resistance range from 10-20% in developed countries (Grant et al., 2002; Ibe et al., 2003; Russell et al., 2009; Shet et al., 2006). Individuals with HIV who contract a drug-resistant strand of the virus have the potential to develop superinfection which is caused by infection with multiple strains of HIV and may include strains that are treatment-resistant. For example, an individual who has developed resistance to one class of antiretroviral medications can be reinfected with an HIV variant that is resistant to a different class of HAART medications (Seth C. Kalichman & Malow, 2004). This variation can be transmitted to uninfected persons in addition to those already infected with HIV. Drug resistance is a concern for not only patients currently on HIV treatment, but for those who are newly infected with the virus and for those who are naïve to treatment or initiating drug therapy (Klimas, et al., 2008).

In addition to biological consequences, nonadherence has also played a role in economic costs at both the macro- and micro-level of society. In the United States, the overall cost for HIV care generally exceeds $20,000 per person annually (Freedberg et al., 2006). Among patients whose CD4 cell counts are <50 cells/mm^3, the cost of care is more than double that of patients with CD4 counts >350 cells/mm^3 (Panel on Antiretroviral Guidelines for Adults and Adolescents, 2009). The majority of these additional health care expenditures in patients with

more advanced disease status are from non-antiretroviral medications and increased hospitalizations. Patients who adhere to their HAART regimens have significantly lower hospital readmissions and decreased stays contributing to reduced utilization of hospital resources (Moore, 1998; Nosyk, et al., 2006). Additionally, second-line treatment for HIV among individuals who develop resistance to a particular class of antiretroviral medications is more expensive than first-line treatments further demonstrating the cost-effectiveness of adherence to HIV regimens (*Adherence to Long-Term Therapies: Evidence for Action*, 2003). In addition to direct medical costs, individuals with HIV have higher rates of clinical progression, morbidity, and mortality. Patients who progress to AIDS status or experience HIV symptoms may become unable to work or perform necessary daily tasks. This loss of labor time as a result of morbidity and mortality and time spent by others caring for the patient demonstrates the indirect economic costs of nonadherence among individuals with HIV and their families (Marlink et al., 2008).

On the macro-level, HIV/AIDS impacts people during their most productive years of life. A majority of the individuals who suffer from HIV/AIDS are between the ages of 15-45. Complications from HIV and clinical progression decrease the individual's ability to contribute to society and contribute to reduced productivity within a society. Labor sector shortages and intergenerational impacts from lowered health and educational investment in children have been well documented in developing countries (Jackson, 1994; Marlink, et al., 2008; Tekola, Reniers, Haile Mariam, Araya, & Davey, 2008; Zaba, Whiteside, & Boerma, 2004). Increasing levels of adherence among HIV patients reduces rapid progression of the disease and further increases quality of life among patients, enabling them to be productive members of society and reducing

the burden on the health care system. The development of interventions, even those that are very expensive and moderately effective, which target increasing adherence has been demonstrated to be cost-effective (Freedberg, et al., 2006; Goldie et al., 2003).

Models of Medication Adherence

Information-Motivation-Behavior Skills Model

Current research concerning interventions addressing HIV medication adherence is dominated by models that address social and cognitive aspects of behavior, such as attitudes, self-efficacy, and values concerning adherence, and social support. The most predominant model is the Information-Motivation-Behavioral (IMB) Model which ascertains that behaviors result from knowledge of accurate information, personal and social motivation, and behavioral skills (J. D. Fisher & Fisher, 1992). This model has been empirically supported and multiple efficacious interventions based on this model have been applied to a broad range of health behaviors such as HIV sexual risk behavior, breast self-examination, and motorcycle safety gear utilization (Amico, Toro-Alfonso, & Fisher, 2005; Ferrer, 2010; J. D. Fisher, Fisher, Misovich, Kimble, & Malloy, 1996; W. A. Fisher, Fisher, & Harman, 2003; Starace, Massa, Amico, & Fisher, 2006).

Prior to the inception of antiretroviral therapy, Fisher & Fisher (1992) established three fundamental determinants to reduce HIV/AIDS risk behavior to prevent transmission: (a) accurate *information* pertaining to transmission of HIV and methods of prevention; (b) *motivation* to change HIV risk behaviors; and (c) possessing the *behavioral skills* necessary to change risky behaviors. After the introduction of HAART, Fisher and colleagues applied this conceptualization to develop the IMB model of antiretroviral (ART) adherence (J. D. Fisher, Fisher, Amico, & Harman, 2006).

On a broad level, this model posits that possession of information, motivation, and behavioral skills related to HIV medication adherence are primary determinants of adherence to antiretroviral medication regimens and will be indicative of HIV-related health outcomes. In order for patients to meet the strict HIV adherence requirements, the individual must have accurate information regarding his or her regimen. This includes information regarding the individually-tailored medication regimen and factors that constitute correct utilization and adequate adherence, any side effects associated with the regimen, and potential drug interactions or toxicities. This component also addresses faulty heuristics and implicit theories regarding HIV medications and adherence (Starace, et al., 2006). For example, a patient may believe that if he or she is feeling well and not experiencing HIV-related symptoms, then he or she is taking enough medications even though the adherence level is well below that recommended. These often inaccurate heuristics may play a strong role in decision-making related to adherence behaviors and influence motivation to follow the medication guidelines.

A patient's motivation to adhere to the prescribed medication regimen plays a critical role in adherence-related behaviors. Fisher et al. (2006) describe two categories of motivation: personal motivation and social motivation. Personal motivation consists of the individual's attitudes and beliefs regarding the potential benefits and costs associated with varying levels of adherence. In order for patient's to establish and maintain optimal adherence long-term, he or she must possess favorable beliefs regarding antiretroviral medications and the health-related outcomes. Social motivation is determined by the individual's perceived level of support from significant others for adherence to the regimen and the individual's motivation to comply with

the wishes of significant others. The possession of accurate information and motivation are prerequisites for patients to enact the behavioral skills required for optimal adherence.

Since antiretroviral therapy is complex and a life-long treatment, patients must have the ability to perform certain behavioral skills in order to meet adherence requirements for greatest benefit from the regimen. These behavior skills encompass a range of objective and perceived abilities which include: (a) acquiring, self-cueing, and self-administering medications; (b) incorporating the regimen into daily life; (c) identify and minimize or cope with the negative side effects; (d) stay current with HAART and adherence-related facts; (e) acquire social support for adherence; (f) communicate effectively with health care providers; and (g) reinforcement for maintaining adherence over time and overcoming barriers to adherence. Each of these skills play a vital role in maintaining optimal levels of adherence.

Within this model, both information and motivation are indirectly associated with adherence-related behavior by means of influencing acquisition and utilization of behavioral skills which are directly related to adherence behaviors. These three components encompass a wide range of factors associated with nonadherence to prescribed HIV medication regimens and identify both idiosyncratic and ecological factors that may moderate adherence. This is the first model of HIV medication adherence to provide a comprehensive, multivariate, theoretical approach (Amico, et al., 2005).

Transtheoretical Model of Behavior Change

The transtheoretical model (TTM) coincides with the IMB model by assessing the individual's readiness to change health-related behaviors. This process consists of five motivational stages of change that have been applied to a variety of health-related behaviors

including smoking cessation, alcohol, safer sex practices, and adherence to medical recommendations among patients with diabetes, arthritis, and obesity (Grimley, Riley, Bellis, & Prochaska, 1993; Keefe et al., 2000; Miller & Rollnick, 1991; J. O. Prochaska et al., 1994; Sarkin, Johnson, Prochaska, & Prochaska, 2001; Vallis et al., 2003). This model asserts that people progress through a series of stages that occur over time and utilizes a series of core constructs which include decisional balance and self-efficacy. In order for behavior change to occur, individuals will progress through the series of stages and accomplish a variety of specific tasks at each stage; however, it is not uncommon for relapse back into a previous stage to occur. Before achieving long-term maintenance of the desired behavior an individual may cycle and recycle through the stages multiple times.

The stages of change consist of five specified changes: precontemplation, contemplation, preparation, action, and maintenance (DiClemente & Prochaska, 1998; James O. Prochaska & DiClemente, 1983; J. O. Prochaska, et al., 1994). In the initial stage of precontemplation, the individual is not currently considering changing a behavior. Most individuals in this stage do not foresee their behavior as a problem and do not see a need for change. Oftentimes, however, the individual's social support network sees the problematic behavior and, when confronted, the individual may become very defensive. An individual in this stage may recognize occasionally missing doses of the antiretroviral medication, but see no reason to change their behavior in the foreseeable future. This person fails to recognize the consequences of inadequate adherence and may not have accurate information regarding the importance of adhering to the prescribed regimen or know what constitutes adequate adherence for HIV medications. Patients with HIV who are in this stage pose serious potential health and quality of life problems.

The next stage is contemplation in which a person is aware that he has a problem and is currently considering making a change, but has not yet committed to action. A patient with HIV in this stage will recognize that taking "drug holidays" on the weekends to avoid the negative effects of mixing substances with the antiretroviral medications is problematic and is aware of the potential health risks associated with this behavior; however, he has not committed to an action plan to stop this risky behavior. The preparation stage is characterized by intention of taking action to change the behavior within the next month and may be marked with small steps toward attempting to change the behavior. In this stage, a patient may increase the number of medications taken weekly, yet still not maintain a 90-95% adherence rate that is adequate for desired clinical outcomes.

In the action stage, the person modifies personal and environmental factors that contribute to the problematic behavior. This stage is often very challenging and takes a considerable amount of time and commitment to overcoming the obstacles (James O. Prochaska & Norcross, 2001). This stage lasts from one day to six months if the person successfully modifies the negative behavior. If a person is able to sustain a 95% adherence rate for more than six months then he has successfully moved into the final stage of the model which is the maintenance stage. In this stage, the individual maintains the desired behavior and steps are taken toward avoiding relapse of the unwanted behavior. By this stage, the individual has gained confidence that he will be able to maintain the changes made (James O. Prochaska, 2008).

In addition to the stages of change, several core constructs are essential to understanding movement from one stage to the next. The first construct is decisional balance which identifies important factors to promote a change in unwanted behavior (James O. Prochaska &

DiClemente, 1983). In essence, decisional balance is weighing the costs and benefits of changing the behavior versus the costs and benefits of maintaining status quo. As individuals progress through the stages of change a shift of the costs and benefits is observed. For instance, in the precontemplation stage, the costs of changing the behavior clearly outweigh the benefits; whereas in the preparation stage onward the opposite pattern emerges (J. O. Prochaska, et al., 1994; Sun, Prochaska, Velicer, & Laforge, 2007). Individuals who are in the contemplation stage and experience ambivalence do so as a result of perceiving the costs and benefits of changing the behavior being essentially equal (James O. Prochaska, 2008). This demonstrates the importance of increasing the individual's awareness of the benefits of changing the problematic behavior and decreasing the costs in order to progress to the action stage.

The second construct, self-efficacy, is an important component to motivate an individual for behavior change and can reasonably predict treatment outcome (Miller & Rollnick, 1991). Self-efficacy is the belief an individual has in his or her capability to successfully perform a particular behavior, such as taking antiretroviral medications as prescribed. An individual's self-efficacy is shaped by information from past experiences (e.g., accomplishments and failures), the perception of others' accomplishments, feedback regarding one's ability to perform the desired behavior, and one's physiological state (Bandura, 1977). Early studies investigating the stages of change demonstrated that self-efficacy was the only variable related to long-term successful behavior change among addictive behaviors, particularly smoking cessation (James O. Prochaska & DiClemente, 1982). Among the HIV population, inconsistent data exists regarding the role self-efficacy plays among medication adherence. Mounting evidence suggests a mediating role between self-efficacy and medication adherence (Catz, et al., 2000; Cha, Erlen, Kim, Sereika, &

Caruthers, 2008; Cook, McCabe, Emiliozzi, & Pointer, 2009; Godin, Côté, Naccache, Lambert, & Trottier, 2005; Malcolm, Ng, Rosen, & Stone, 2003). Godin and colleagues (2005) found that high self-efficacy in combination with a positive attitude towards antiretroviral medications predicted better adherence compared to participants with low perceived self-efficacy and a negative attitude. Developing positive expectations regarding one's ability to perform the prescribed HIV regimen daily and in challenging circumstances, as well as instilling positive expectations regarding outcomes of taking the medication are an important part in improving adherence.

Utilization of the core constructs of the transtheoretical model (i.e., stages of change, decisional balance, self-efficacy) has become increasingly popular among health care providers to motivate HIV patients to maintain adequate adherence levels (Cook, et al., 2009; Holstad, DiIorio, & Magowe, 2006; Safren, Otto, & Worth, 1999). The application of the transtheoretical model within the framework of the information-motivation-behavioral skills model has led to the development of efficacious interventions for improving adherence among this population.

Interventions Designed to Enhance Medication Adherence

Significant progress has been made in developing efficacious interventions for enhancing adherence, but several barriers limit wide dissemination and adoption of these practices. Health care providers have implemented a variety of interventions designed to increase adherence to medication regimens. Many of these interventions are multi-component and consist of using memory-prompting devices (i.e., medication cards, pillboxes), increasing social support, and use of motivational strategies. In a review of 88 descriptive and intervention studies, Sandelowski, and colleagues (2009) found that cognitive behavioral interventions were most prevalently used

to address problems with medication adherence. These interventions were directed towards knowledge, beliefs about HIV infection and antiretroviral therapy, social support, and behavioral strategies. Multiple studies have demonstrated that medication adherence is not a static, one-dimensional behavior; rather, multiple emotional, cognitive, and behavioral factors that frequently change influence adherence (Johnson, et al., 2003; Remien et al., 2003; Sandelowski, Voils, Chang, & Lee, 2009). Thus, effective interventions should target each of these factors and include components of education, skills-building, and problem-solving techniques (Johnson, et al., 2003).

Memory Prompting Devices

Patients with HIV have frequently cited that "forgetting" to take their HIV medications is the most common reason for nonadherence (X. Wang & Wu, 2007). The use of memory prompting devices may help to overcome this impediment. Limited data exists examining the use of memory prompting devices only to enhance adherence. Several studies used these devices in conjunction with a multi-component intervention. One study investigated the use of a memory prompting device among HIV patients with cognitive impairments and found that adherence did improve among patients who used the electronic-reminder devices compared to a control group (Andrade et al., 2005).

Mannheimer and colleagues (2006) conducted a randomized controlled trial investigating the efficacy of two different approaches to adherence interventions. The first intervention was based on the IMB model and consisted of a trained staff member providing individually tailored support over time utilizing a standardized protocol which identified and addressed the participant's information, motivation, and behavior skills for antiretroviral adherence. The

second intervention utilized an electronic medication reminder system that was individually programmed to sound and flash at the time of all doses. Participants in the first intervention demonstrated significant reductions in virologic failure, sustained CD4 cell counts, and better long-term adherence. In contrast, participants in the electronic medication reminder condition showed higher rates of virological failure. These results indicated that an interpersonal, multifaceted, long-term adherence intervention is efficacious in improving HIV adherence and suggests that this type of intervention is preferred over the medication monitoring devices.

Memory prompting devices have demonstrated improvements in adherence among patients with cognitive impairment; however, the use of these devices does not appear to have the desired effects among most patients taking antiretroviral medication (Andrade, et al., 2005; Sharon B. Mannheimer et al., 2006). Several limitations are inherent within the utility of these devices including concerns about confidentiality and problems with the batteries and the device malfunctioning (Sharon B. Mannheimer, et al., 2006). Additionally, the devices fail to address potential barriers associated with inadequate adherence such as medication side effects, substance use, depression, and psychosocial issues. This demonstrates the need for comprehensive, multifaceted interventions for HIV adherence.

Brief Motivation Interviewing (BMI)

Brief motivational interviewing (BMI) has demonstrated efficacy in promoting adherence to antiretroviral medications (Adamian, Golin, Shain, & DeVellis, 2004; DiIorio et al., 2008; Golin et al., 2006). The foundation of BMI is within the transtheoretical model that describes stages of readiness to change and processes used by individuals to make intentional behavior change. BMI is a client-centered approach that seeks to increase intrinsic motivation and reduce

ambivalence (Miller & Rollnick, 1991). Initiation of behavior change is accomplished by creating dissonance between a patient's current behavior and the target behavior, without judging, criticizing or blaming the patient or generating a hostile environment (Possidente, Bucci, & McClain, 2005). This counseling style was originally developed for treatment with substance abuse and later adapted to facilitate change among a broader spectrum of health behaviors, including medication adherence. DiIorio and colleagues (2008) are among the first to conduct a randomized controlled trial investigating the use of motivational interviewing to promote adherence to antiretroviral treatments. This intervention aimed to build confidence, reduce ambivalence, and increase motivation for adherence through five counseling sessions over a three-month period. Results indicated that participants who received MI were taking a greater percentage of the prescribed doses and a significantly greater percentage of doses on time in comparison to a control group. This study provides support for a client-centered approach that aims to increase intrinsic motivation and reduce ambivalence toward HIV medication adherence.

Not all studies investigating motivational interviewing, however, have demonstrated MI to be more efficacious than adherence education only. One randomized controlled trial investigating the efficacy of MI on medication adherence among HIV patients with a history of alcohol problems and found that MI was not associated with changes in medication adherence, biological markers of disease progression, or alcohol consumption (Samet et al., 2005). This study used self-reported measures in contrast to objective measures employed by DiIorio et al. (2008). Further, the authors noted that sample size and limited exposure to the intervention for some participants may have contributed to the unexpected outcome.

Motivational interviewing addresses a very important component of behavior change; however, MI alone may not fully address the broad spectrum of factors associated with HIV medication adherence. Multicomponent interventions based on the information-motivation-behavioral skills model that incorporate MI into additional psychological techniques (i.e., cognitive behavioral therapy) have become more prevalent in the literature and demonstrated efficacy (Parsons, et al., 2007; Parsons, Rosof, Punzalan, & Di Maria, 2005; Sandelowski, et al., 2009)

Cognitive Behavioral Therapy

Cognitive behavioral therapy (CBT) has been empirically supported to enhance adherence to antiretroviral medication (Holzemer et al., 2006; Koenig et al., 2008; Reynolds et al., 2008; Safren et al., 2009). This intervention is one of the most widely used and empirically supported interventions to improve mental health functioning (Crepaz et al., 2008). The focus of CBT is on the interaction between maladaptive thought patterns, feelings, and behaviors. Crepaz et al. (2008) conducted a meta-analysis of cognitive behavioral interventions used to improve mental health functioning among individuals who are HIV-positive. The authors found that CBT was efficacious for improving psychological symptoms of depression, anxiety, anger, and stress compared to control groups. Further, Safren et al. (2009) conducted a randomized controlled trial using CBT to treat HIV patients with depression and inadequate rates of adherence to antiretroviral medications. This study demonstrated significantly improved outcomes in both medication adherence and depression among patients receiving cognitive behavior therapy.

Cognitive-behavioral interventions are among the most prevalent interventions used to address multiple components of medication adherence (Sandelowski, et al., 2009). Several

randomized controlled trials have demonstrated significant changes in adherence post-intervention utilizing these interventions (Goujard et al., 2003; Koenig, et al., 2008; Milam et al., 2005; Parsons, et al., 2005; Safren, et al., 1999; Tuldrà et al., 2000). These interventions focus on delivering accurate information to clients regarding HIV and the importance of adherence. Further, patients are engaged in a series of skills-building techniques and problem solving strategies. This includes conducting a functional analysis of individual antecedents for medication adherence behaviors and teaching patients strategies to cope with side effects and increasing social support. CBT provides patients with necessary skills to effectively cope with irrational thoughts and problem behaviors that contribute to medication nonadherence. This intervention, in combination with motivational interviewing, addresses each component of the information-motivation-behavioral skills model and provides patients with a variety of strategies to improve adherence and clinical outcomes.

Life Steps

The *Life Steps* program is a brief adherence intervention that combines components from several efficacious intervention approaches including both BMI and CBT, and has evidence of efficacy. Safren and colleagues developed the *Life Steps* program based on principles of cognitive behavior therapy, motivational interviewing, and problem-solving therapy to help patients identify and solve problems with medication adherence (Safren et al., 2001). This brief, single-session intervention is designed to provide patients with education and training to adhere to their medication regimen. The Life-Steps program consists of the following eleven informational, problem-solving, and cognitive behavioral steps: (1) introduction and psychoeducation; (2) transportation to appointments; (3) obtaining medications; (4)

communicating with providers; (5) coping with side effects; (6) formulating a daily medication schedule; (7) storing medication; (8) cues for pill taking; (9) guided imagery review of successful adherence in response to daily cues; (10) responses to slips in adherence; and (11) review of procedures. This intervention was based on previous evidence that brief, cognitive behavioral and problem-focused interventions improved medication adherence for a wide range of chronic illnesses such as diabetes and asthma (Bailey et al., 1990; Méndez & Beléndez, 1997). More recent studies have supported the use of combined MI and CBT to improve medication adherence among HIV patients with a variety of comorbid conditions including alcohol abuse and depression (Parsons, et al., 2007; Safren, et al., 2009).

The development of the *Life Steps* program was based on empirically supported treatments for medication adherence. This program sought to combine techniques from MI, CBT, and problem-solving therapy into a brief, single session program. Safren and colleagues (2001) compared the *Life Steps* program to self-monitoring of medication adherence which has also been supported in the empirical literature (Safren, et al., 2001). Results demonstrated improvements in adherence in both conditions at two weeks posttreatment and 12-weeks posttreatment; however, the *Life Steps* condition showed faster improvements in adherence rates than the self-monitoring condition. This suggests that the inclusion of problem-solving and motivational interventions can be an effective tool at increasing medication adherence within a brief, single session therapeutic format.

Limitations of Current Interventions

Although the development of effective interventions is a promising step, several practical barriers limit the likelihood of widespread dissemination and adoption of these methods.

Intervention approaches that are delivered by clinical staff place additional time and expense burdens on health care systems and professionals that are already under heavy demands of patient care. To provide ideal interventions with fidelity to evidence-based approaches, additional burdens of training and supervision are necessary. Electronic interventions could overcome these barriers and aid dissemination of an efficacious, cost-effective, and high-fidelity intervention in the clinic setting.

Recent studies have begun to investigate the use of electronic media (e.g., telephones, personal digital assistants, pagers, and web-based interventions) to improve medication adherence among patients with HIV and other chronic illnesses. Cost-effective interventions requiring little to no additional time from health care staff that are readily accessible to a large portion of patients are needed among populations with a wide array of medical concerns including diabetes, HIV/AIDS, osteoporosis, and asthma (Bender et al., 2010; Cook, Emiliozzi, & McCabe, 2007; Cook, et al., 2009; Sacco, Malone, Morrison, Friedman, & Wells, 2009).

Among these interventions, the use of messaging systems and personal digital assistants (PDAs) has received increasing, yet modest support. Pagers are easily integrated into an individual's daily routine and have been demonstrated to improve self-reported medication adherence (Erickson, Ascione, Kirking, & Johnson, 1998). Pagers are used to send educational messages, support, and medication reminders to patients and do not require extensive time commitments by health care professionals. Recently, a randomized controlled trial investigating the efficacy of pager messaging to improve adherence to HIV medication and clinical outcomes found that the participants receiving the pager messaging intervention displayed some clinical improvement (CD4 count and viral load); however, the intervention was not successful in

improving adherence and, in fact, demonstrated a worsening trend in adherence at six months (Simoni et al., 2009). These results suggest that the pager message may not have served as a reminder to take the medication at the scheduled time as expected. Further, the messages alone were not sufficient enough to overcome the range of factors contributing to nonadherence. This demonstrates the importance of providing patients with educational and psychological interventions addressing these barriers to adherence.

The use of telephone-delivered interventions has become prevalent within the literature. This method of intervention delivery has been supported by recent investigations that have utilized a psychological model to promote behavior change. A majority of these interventions have been delivered by nurses trained in psychological counseling interventions based on MI and CBT (Cook, et al., 2007; Cook, et al., 2009; Reynolds, et al., 2008). The use of telephone counseling among HIV patients has demonstrated improved rates of adherence among patients during the study period; however, only one study demonstrated sustained high levels of adherence at 32, 48, and 64 weeks post-intervention (Reynolds, et al., 2008). Participants in this study already had extremely high levels of adherence at baseline ($\geq$ 95%) in both the intervention and control groups which is not representative of the HIV population in general and limits generalizability of the results. Cook et al. (2009) also reported increased adherence among participants receiving telephone counseling. A major limitation of this study, however, was the lack of a comparison group that did not receive the intervention. Further, this study had a high rate of attrition over the course of the intervention with almost 60% of participants lost by the six month follow-up telephone call. High levels of attrition have been a concern with telephone-

delivered interventions among other chronic illnesses as well (Cook, et al., 2007; Sacco, et al., 2009).

In addition to high rates of attrition, several concerns regarding the use of telephone-delivered interventions have been identified. First, although the telephone intervention is more cost-effective for the patient, employing registered nurses to deliver the intervention continues to place time constraints on the health care system and are too expensive to be widely adopted (Sacco, et al., 2009). Second, program nurses have reported difficulty contacting patients, including disconnected telephone numbers, which pose an important concern for high levels of attrition from the intervention. Current research suggests that patients who drop out of this type of intervention are potentially those with a higher risk of medication nonadherence and may benefit the most from an intervention to improve adherence (Cook, et al., 2007). Although telephone-delivered interventions are limited, these studies have demonstrated that empirically supported psychological techniques can be successfully applied via telehealth delivery in general health care settings.

In order to compensate for the limitations of telephone counseling, the use of digital video on personal digital assistants (PDAs) has been presented as a means of educating patients about their disease and treatment and used as a medication reminding tool (Brock & Smith, 2007; Mayhorn, Lanzolla, Wogalter, & Watson, 2005). Brock & Smith (2007) evaluated the use of digital video on PDAs in a clinic setting among patients with HIV. The video incorporated information aimed at increasing patient self-efficacy via education about the disease and treatment. The authors reported that participants enjoyed the video and found it to be an appropriate means of delivering educational information, regardless of literacy level. The results

indicated increased knowledge of disease, medications, and adherence behaviors after watching the video. Further, self-efficacy was high post-intervention and maintained at follow-up and self-reported adherence to medication regimens improved.

Although these findings are encouraging and support the implementation of technology-assisted education in the clinical health care setting, the methodology used in this study has multiple limitations. First, there was not a control group and, therefore, it is difficult to ascertain the effects demonstrated were not due to other confounding variables. Second, biological indicators of HIV (e.g., CD4 count, viral load) were not collected; therefore, severity of disease may have confounded the results and objective levels of adherence were not examined. Additionally, the study was limited to only two clinic visits, including a follow-up at the next scheduled visit. The authors did not report the timeframe between the intervention and follow-up and did not report whether it was standardized for each participant. This important limitation makes it impossible to determine if the effects seen in increased self-efficacy, adherence, and knowledge regarding HIV and medications were sustained. This study does provide support for the feasibility and convenience of electronic educational tools in healthcare settings among patients with HIV and further investigation of determining the efficacy of these interventions is warranted.

The use of technology-assisted education is a convenient, economical solution to the current limitations imposed upon health care providers. This type of intervention requires minimum training and time by clinic staff and can be implemented in clinic waiting rooms. Additionally, this technology has the potential to be used in rural settings that lack access to psychological interventions and may be adapted to be used with a wide array of chronic illnesses

requiring stringent medication adherence. Developing electronic interventions based on currently existing empirically supported interventions may help alleviate the gap between patient nonadherence and the barriers that limit practitioners from delivering comprehensive, multifaceted effective interventions aimed at increasing adherence. Adapting an efficacious program for HIV medication adherence, such as the *Life Steps* intervention, may be an effective technology-assisted educational tool.

While the evidence for *Life Steps* is promising, the dissemination and adoption of the program is limited by the expense of professional staff, training needs, and concerns about treatment fidelity. The development of a brief, computerized intervention adapting the components of *Life Steps* and targeting medication adherence may reduce the already demanding time constraints placed on physicians and health care providers. Further, this intervention will be economically feasible and cost-effective and easily disseminated among patients who are at-risk for nonadherence, particularly patients who are initiating treatment, changing regimens, or have demonstrated previous failures to adhere to the regimen. This program could be included on a compact disc or made available via the internet allowing easy access to developing skills for adherence and periodic review of procedures.

THE PRESENT STUDY

The purpose of the present study is to develop an innovative computer-based adaptation of the evidence-based *Life Steps* program and evaluate the efficacy of the electronic intervention to enhance medication adherence and improve clinical outcomes among individuals with HIV via a randomized controlled trial. By achieving these aims, the project will develop and rigorously test the efficacy of an intervention modality that will address the problem of nonadherence in an efficient and cost-effective way.

The study will progress through three phases. Phase One will consist of developing the electronic intervention and creating a script for the "electronic interviewers" to use in guiding the participant through the intervention. The script for the interviewers will be developed based upon the *Life Steps* program and will strive to adhere as closely as possible to what would be expected of a live interviewer with expertise in the technique. Once the script is completed, the material will be digitally prepared and stored for later inclusion in the interactive intervention. The intervention itself will be created using Adobe Presenter software, an off-the-shelf development application commonly used to produce distance education and training applications. This software allows for presenting the intervention in an engaging, interactive and navigable way, while also allowing for testing participant comprehension via embedded quizzes. The "electronic interviewer" will participate in the *Life Steps* program process by walking the participant through each step, and providing explanatory and motivational commentary.

In addition to the computer-based information, we will prepare a user-journal that each participant will use in conjunction with the program. The journal will include worksheets and written resources to supplement the computer information and provide the user with some

written materials for the participant to retain after the computer interaction. The journal will also include a copy of the *Life Steps* program on a USB flash drive for subsequent review by the participant if needed.

Consistent with the original *Life Steps* intervention, the assessment intervention itself will include 11 informational, problem-solving, and cognitive behavioral steps, each presented as a separate module. Completion of one module will direct the participant directly to the subsequent module. The modules are as follows:

Step 1: Education and Introduction. This module will provide information about the critical role medication adherence plays in successful treatment. An understandable rationale for the medication regimen and adherence to the regimen will be provided. The aim of the education component is to increase knowledge and a sense of self-efficacy to influence their HIV treatment success. Patients will be reminded that, unlike other medications, antiretroviral medications are taken to prevent the occurrence of certain symptoms; however, they may cause negative side effects. Motivation for taking pills as recommended will be discussed in reference to the goal of blocking viral replication, reducing viral load, and preventing drug-resistant strains of HIV from emerging. This information will be supplemented with animated illustrations. The introduction will address two primary goals: (a) promote the perspective that the pills are health-protecting tools; and (b) introduce problem-solving for medication adherence.

Step 2: Transportation to Appointments. This module involves problem-solving strategies and rehearsal techniques. The aim of this module is to address transportation issues in advance so patients will not miss important appointments with their health care providers. Further, brief cognitive-restructuring and problem-solving approaches can be employed for cognitive

distortions regarding the reactions of other people (i.e., coworkers, classmates, friends and family) to their recurrent appointments.

Step 3: Obtaining Medications. Patients will develop a plan for continued access to medications, including payment, selection of a pharmacy, and back-up plans. This module will also address concerns regarding patient's privacy and confidentiality with the pharmacist.

Step 4: Communicating with Physicians, Nurses, and Other Members of the Treatment Team. Patients with HIV are frequently embarrassed about asking providers health-related questions. An example of an interaction between a patient and provider will be provided via a brief video. Brief cognitive techniques will be suggested for irrational fears about asking questions.

Step 5: Coping with Side-Effects. In this module participants are asked to (a) help themselves pick a regimen collaboratively with their doctor to minimize side effects; (b) re-interpret the initial side effects as signs that the medications are in their bloodstream and working; (c) increase the salience of the reasons for taking medications despite the side effects.

Step 6: Formulating a Daily Medication Schedule. The goal of this module is for the patient to complete a detailed map of an average day of pill-taking, specifying environmental and other cues for pill-taking throughout the day. The participant will focus on linking medication doses to regular activities, disentangle a complex regimen (i.e., food restrictions with doses), and identify specific times that are potential risks for missing doses. The user-journal will include worksheets to develop a personalized daily medication schedule.

Step 7: Storing Medications. In addition to complex schedules, many HIV regimens require some medications to be refrigerated which may pose a problem for patients when they

are not at home. This module focuses on problem-solving techniques and discusses additional interventions for storing medications including pill boxes or zip-lock bags marked with appropriate time, food restriction, and refrigeration information.

Step 8: Cues for Pill-Taking. The user-journals will include a set of colored adhesive dots. This module illustrates how to use these dots as a cue for pill taking by placing them in various spots (i.e., bathroom mirror, computer at work, the receiver of a telephone) where they will see them. These dots are used as a cue for pill taking and to rehearse adaptive cognitions for adherence (i.e., "by taking my pills on time I have done my part to take care of my body"). Additionally, overt reminders such as linking pill taking with waking up and going to bed or setting alarms are discussed.

Step 9: Guided Imagery Review of Successful Adherence in Response to Daily Cues. This module will help patients imaginally rehearse a full day of adherence and will include the cues identified in Step 8, rehearsal of adaptive cognitions, and use of relevant sensory cues to intensify the imagery.

Step 10: Responses to Slips in Adherence. It is likely that at some point, the patient will miss a dosage. This module teaches patients how to handle slips and to avoid all-or-nothing thoughts. This module introduces cognitive techniques to convey the view that, although the goal is to maintain perfect adherence, if a lapse occurs, the best choice is to return to the regimen as soon as possible.

Step 11: Review of Procedures. To help patients remember the strategies discussed, this module reviews the previous steps and provides feedback to the client regarding any action items

such as questions to ask the physician, purchasing a refrigerator bag or pill box, purchasing an alarm watch, or placing the colored dots.

Phase Two will consist of implementing a randomized trial with HIV patients who are either new patients or at-risk for nonadherence to investigate the effectiveness of the new intervention. Patients will be recruited through a community health center that serves primarily patients living with HIV. Participants who meet the screening criteria will be randomly assigned (by computer generated number) to one of the following conditions: (1) Treatment as usual (TAU) or (2) TAU + *Life Steps* electronic intervention. We estimate completion of the intervention to take approximately 90-120 minutes.

Immediately after the intervention, participants will complete a brief program satisfaction questionnaire to rate their experience with the intervention, self-efficacy to properly take and manage their medications, commitment to adhere to medication regimens, and to indicate their current intentions to make any changes in their medication-taking behavior. At one, three, and six months, participants will be re-contacted and will complete a brief interview to indicate their current levels of adherence and problems experienced in the last month. Each interview should take approximately 30 minutes.

Phase Three will be devoted to completing all follow-up interviews, and data compilation and analysis. The effects of the intervention will be evaluated by the following hypotheses:

Hypothesis 1. Participants in the *Life Steps* electronic intervention will report higher self-efficacy and commitment to maintain adherence to their medical regimens as compared to those in the TAU condition.

Hypothesis 2. Participants in the *Life Steps* electronic intervention will demonstrate greater self-reported medication adherence than those in the TAU condition.

Hypothesis 3. Participants in the *Life Steps* electronic intervention condition will demonstrate superior viral load and immunologic outcomes (decreased viral load and increased CD4 count) compared to those in the TAU condition.

Hypothesis 4. Participants in the *Life Steps* electronic intervention condition will report high satisfaction with the intervention.

METHODOLOGY

Participant Recruitment and Selection

One-hundred patients (50 participants in each condition) with HIV who currently are prescribed an antiretroviral medication regimen will be recruited for this study from the *Internal Medicine Specialty Services* in Tulsa, Oklahoma, an outpatient clinic at the Oklahoma State University Center for Health Sciences that serves primarily patients living with HIV. Patients who are (a) infected with HIV, (b) over the age of 18, (c) currently prescribed a Highly Active Antiretroviral Therapy (HAART) regimen, (d) prescribed a drug regimen for the first time, changing regimens, or report adherence below 95%, and (e) agree to three brief follow-up interviews over the course of one year, will be invited to participate in the study.

Measures

Participants who meet the inclusion criteria will complete a questionnaire (see Appendix) including six measures assessing demographic information, adherence to HIV medications (*AACTG Medication Adherence Questionnaire*), self-efficacy to adhere to HIV regimen (*HIV Treatment Adherence Self-Efficacy Scale*), commitment to adhere to HIV regimen, quality of life

(*McGill Quality of Life Questionnaire*), and intervention satisfaction (*The Program Satisfaction Questionnaire*).

Demographics Questionnaire. Information regarding gender, age, and ethnicity will be gathered using the demographics questionnaire. Additional information regarding the participants' current living situation, marital status, sexual orientation, and educational attainment will also be collected.

AACTG Medication Adherence Questionnaire. Self-reported adherence to HIV medications will be assessed using the AACTG Medication Adherence Questionnaire (M. A. Chesney, et al., 2000). This instrument was developed by the Adult AIDS Clinical Trials Group (AACTG) and is a five-item self-report measure that has been used extensively in the United States and internationally to assess adherence to antiretroviral medications (Reynolds et al., 2007). This measure queries patients on the number of doses he or she has missed of each medication during each of the last four days. Additionally, other adherence behaviors are assessed such as following specified instructions, missing doses on the weekend, and how closely the patient followed the specific schedule. To assess adherence, researchers have frequently analyzed data collected with the first item of the questionnaire only ("How many doses did you miss yesterday/2 days ago/3 days ago/4 days ago") by averaging these responses and excluding the other four questionnaire items.

Reynolds, Sun, Nagaraja, Gifford, Wu & Chesney (2007) examined the psychometric properties of each item and compared the common approach of averaging data from the first item to alternative methods using principal component analysis and the entire questionnaire. The results suggested that using the first item only provided a valid and reliable measure of

adherence; however, the strength of measure of adherence improved with inclusion of the remaining items of the questionnaire. The authors presented a formula for calculating an adherence index obtained via principal component analyses and weighted each of the items. This formula, when compared to the 4-day recall only item, was less skewed and compared favorably with two objective measures of adherence (MEMS electronic monitoring system and plasma HIV RNA). The AACT Medication Adherence Questionnaire has demonstrated good reliability (Cronbach's alpha = .80).

HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES). Self-efficacy for adherence to HIV medications will be assessed using the HIV-ASES (Johnson et al., 2007). The HIV-ASES is a 12-item scale of patient confidence in their ability to carry out behaviors related to adhering to medication regimens. Responses range from 1 ("cannot do it at all") to 10 ("completely certain can do it"). Item scores are averaged with higher scores indicating higher adherence self-efficacy. Analysis of the HIV-ASES has revealed robust internal consistency (.90) and reliability (.91).

Commitment to Adhere to HIV Medication Regimens. This item was developed for the purposes of this study and consists of a single question addressing the participant's level of commitment to adhere to the currently prescribed antiretroviral medication regimen. Responses range from 0 ("not committed at all") to 10 ("completely committed") with high scores demonstrating higher levels of commitment to adherence.

McGill Quality of Life (MQOL). Quality of life will be assessed using the McGill Quality of Life questionnaire (Cohen, Hassan, Lapointe, & Mount, 1996). This instrument is a 16-item scale that assesses quality of life in four domains: physical well-being, psychological well-being,

existential well-being, and support; each item is assessed on a 0-10 point scale. The MQOL has been widely used in research for people with life- threatening illnesses and has been translated and validated in a variety of languages. The MQOL has demonstrated good internal validity (0.74-0.92) and test-retest reliability (0.70) (Cohen et al., 1997).

Clinical outcomes. Medical records for each subject will be reviewed for the most recent laboratory test results of $CD4^+$ cell counts, viral load, and occurrence of opportunistic infections.

Program Satisfaction Questionnaire. This questionnaire was developed for the purposes of this study to address the level of satisfaction with the intervention. This questionnaire consists of eight items assessing level of agreement or disagreement with the statement, such as "I would recommend this program to a friend" and "I learned new things from the program."

Treatment Procedures

Participants who meet the general screening criteria will be randomly assigned (by computer generated number) to one of two groups: (1) Treatment as usual (TAU) or (2) TAU + *Life Steps* electronic intervention. It is estimated that completion of the intervention will take approximately 90-120 minutes.

Immediately following the intervention, participants will complete a brief program satisfaction questionnaire to rate their experience with the intervention, self-efficacy to properly take and manage their medications, commitment to adhere to medication regimens, and to indicate their current intentions to make any changes in their medication-taking behavior. At three, six, and twelve months, participants will be re-contacted and will complete a brief interview to indicate their current levels of adherence and problems experienced in the last month. Each interview should take approximately 30 minutes.

PROPOSED ANALYSES

Preliminary Analyses

A randomization check will be conducted to verify that there are no statistically significant differences between the two conditions on key baseline variables. Specifically, chi-square tests will be conducted to assess for any significant differences with regard to age, gender, ethnicity, current living situation, marital status, sexual orientation, educational attainment, and the presence of an opportunistic infection. A *t*-test will assess for meaningful differences with regard to viral load and CD4 cell count

Primary Analyses

Hypothesis One. Participants in the Life Steps electronic intervention condition will report high satisfaction with the intervention. Means and standard deviations for a participant satisfaction measure will be evaluated and compared to the scale anchors to determine if the level of satisfaction is relatively high or low.

Hypothesis Two. Participants in the Life Steps program will report higher self-efficacy and commitment to maintain adherence to their medical regimens as compared to those in the TAU condition. Immediate post-intervention scores on measures of self-efficacy for treatment adherence and commitment to adherence will be calculated for all participants. Differences between groups will be evaluated with *t*-tests of the group means, assuming there are not significant differences in demographic variables at baseline. If significant demographic variables exist, they will be included as covariates in ANCOVA analyses of between group means. If the hypothesis is supported, there will be a significant difference between the two conditions, with

participants in the *Life Steps* condition reporting higher scores of self-efficacy (HIV-ASES) and commitment to adherence.

Hypothesis Three. Participants in the Life Steps electronic intervention condition will demonstrate greater self-reported medication adherence than those in the TAU condition. Between-group differences in self-reported adherence will be evaluated at each follow-up time point with *t*-tests of group means (or ANCOVA if necessary, as above). Time (*Post-intervention and 3-month follow-up*) × Treatment (*TAU, Life Steps*) interaction effects in mixed model ANOVAs will also be evaluated to examine differences in patterns of change in adherence over time between the two groups. A significant difference on measures of adherence, with the *Life Steps* condition demonstrating higher scores on the ACTG Medication Adherence Questionnaire would confirm this hypothesis.

Hypothesis Four. Participants in the Life Steps electronic intervention condition will demonstrate superior viral and immunologic outcomes (viral load and CD4 count) compared to those in the TAU condition. Between-group differences in CD4 count and viral load will be evaluated at each follow-up time point with *t*-tests of group means (or ANCOVA if necessary, as above). Time (*Post-intervention and 3-month follow-up*) × Treatment (*TAU, Life Steps*) interaction effects in mixed model ANOVAs will also be evaluated to examine differences in patterns of change in viral and immunologic outcomes over time between the two groups. A significant difference on measures of CD4 count and viral load, with the *Life Steps* condition demonstrating an increase in CD4 count and a decrease in viral load would confirm this hypothesis.

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APPPENDIX B
Measures

Demographics Questionnaire

Participant ID# _____
Date of Birth: _____

Gender: □ Male □ Female

Ethnicity:
□ Caucasian or White □ Hispanic or Latino □ Biracial/Mixed
□ African-American or Black □ Asian □ American Indian
□ Pacific Islander □Other _____ □ Prefer not to respond

Educational Attainment:
□ Some High School □ Some College □ Master's-level
□ High School □ College □ Doctoral-level
□ Prefer not to respond

Marital Status:
□ Never married □ Married □ Divorced
□ Remarried □ Separated □ Common Law
□ Domestic Partnership □ Widowed □ Live w/ same sex partner
□ Live w/ opposite sex partner □ Prefer not to respond

Housing Status:
□ Your house/apt □ Someone else's house/apt □ Transitional housing
□ On the street □ Institution ≤ 30 days □ Institution > 30days

Self-identified Sexual Orientation:
□ Bisexual □ Gay/lesbian □ Heterosexual
□ Undecided □ Prefer not to respond

What is/are the most likely way/s that you became infected with HIV?
□ Sex with a man who was HIV+
□ Sex with a woman who was HIV+
□ Shared needles with someone who was HIV+
□ Blood transfusion or other medical procedure
□ Don't know
□ Other (needle stick at work, etc.) _____
□ Prefer not to respond

HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES)

I am going to ask you about situations that could occur during your treatment for HIV. Treatment can involve different things for different people. Sometimes, this might refer to taking medications, and other times it could refer to other things that you do to deal with HIV such as diet and exercise or taking vitamins. So, in these questions, when I ask you about your "treatment" or your "treatment plan," I am talking not only about any medications that you might be taking for HIV, but also other things that make up your self-care.

For the following questions I will ask you to tell me in the past month, including today, how confident you have been that you can do the following things. Use this response ranging from 0 ("cannot do at all") to 10 ("completely certain can do").

0	5	10
Cannot do at all	Moderately certain can do	Completely certain can do

In the past month, how confident have you been that you can:

1. Stick to your treatment plan even when side effects begin to interfere with daily activities?
2. Integrate your treatment into your daily routine?
3. Integrate your treatment into your daily routine even if it means taking medication or doing other things in front of people who don't know that you are HIV-infected?
4. Stick to your treatment schedule even when your daily routine is disrupted?
5. Stick to your treatment schedule when you aren't feeling well?
6. Stick to your treatment schedule when it means changing your eating habits?
7. Continue with your treatment even if doing so interferes with your daily activities?
8. Continue with the treatment plan your physician prescribed even if your T-cells drop significantly in the next three months?
9. Continue with your treatment even when you are feeling discouraged about your health?
10. Continue with your treatment even when getting to your clinic appointments is a major hassle?
11. Continue with your treatment even when people close to you tell you that they don't think that it is doing any good?
12. Get something positive out of your participation in treatment, even if the medication you are taking does not improve your health?

ACTG Medication Adherence Questionnaire

This questionnaire asks about your HIV study medications that you took over the last four days.

Most people with HIV have many pills to take at different times during the day.

Many people find it hard to always remember their pills:

- Some people get busy and forget to carry their pills with them.
- Some people find it hard to take their pills according to all the instructions, such as "with meals," or "on an empty stomach,""every 8 hours,""with plenty of fluids."
- Some people decide to skip doses to avoid side effects or to just not be taking pills that day.

We need to understand how people with HIV are really doing with their pills. Please tell us what you are **actually** doing. Don't worry about telling us that you don't take all your pills. We need to know what is really happening, not what you think we "want to hear."

A. This section of the questionnaire asks about the study medications that you may have <u>missed</u> taking over the last four days. Please complete the following table by filling in the boxes below.

IF YOU TOOK ONLY A <u>PORTION</u> OF A DOSE ON ONE OR MORE OF THESE DAYS, PLEASE REPORT THE DOSE(S) AS BEING <u>MISSED</u>.

Step 1 **Names of your anti-HIV drugs**	HOW MANY DOSES DID YOU **<u>MISS</u>**…			
	Step 2 Yesterday	**Step 3** Day before yesterday (2 days ago)	**Step 4** 3 days ago	**Step 5** 4 days ago
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses
	____ doses	____ doses	____ doses	____ doses

If you only took a portion of a dose on one or more of these days, please report the dose(s) as being missed.

B. During the past 4 days, on how many days have you missed taking all your doses?

□ None
□ One day
□ Two days
□ Three days
□ Four days

C. Most anti-HIV medications need to be taken on schedule, such as "2 times a day" or "3 times a day" or "every 8 hours." How closely did you follow your specific schedule over the last four days?

□ Never
□ Some of the time
□ About half of the time
□ Most of the time
□ All of the time

D. Do any of your anti-HIV medications have special instructions, such as "take with food" or "on an empty stomach" or "with plenty of fluids?"

□ Yes
□ No

If yes, how often did you follow those special instructions over the last **four** days?

□ Never
□ Some of the time
□ About half of the time
□ Most of the time
□ All of the time

E. Some people find that they forget to take their pills on the weekend days. Did you miss any of your anti-HIV medications last weekend— last Saturday or Sunday?

□ Yes
□ No

F. When was the last time you missed any of your medications? Check one.

- □ Within the past **week**
- □ 1-2 **weeks** ago
- □ 2-4 **weeks** ago
- □ 1-3 **months** ago
- □ More than 3 **months** ago
- □ **Never** skip medications or **not applicable**

*If you **Never** skip medications, please skip **Section G**. Otherwise, please continue by answering the next set of questions.*

G. People may miss taking their medications for various reasons. Here is a list of possible reasons why you may miss taking your medications. How often have you missed taking your medications because you: (Circle one response for each question.)

	Never	Rarely	Sometimes	Often
1. Were away from home?	0	1	2	3
2. Were busy with other things?	0	1	2	3
3. Simply forgot?	0	1	2	3
4. Had too many pills to take?	0	1	2	3
5. Wanted to avoid side effects?	0	1	2	3
6. Did not want others to notice you taking medication?	0	1	2	3
7. Had a change in daily routine?	0	1	2	3
8. Felt like the drug was toxic/harmful?	0	1	2	3
9. Fell asleep/slept through dose time?	0	1	2	3
10. Felt sick or ill?	0	1	2	3
11. Felt depressed/overwhelmed?	0	1	2	3
12. Had problems taking pills at specified times (with meals, on empty stomach, etc.)	0	1	2	3
13. Ran out of pills?	0	1	2	3
14. Felt good?	0	1	2	3

Confidence and Commitment Measure

How CONFIDENT are you that you can maintain 100% adherence with taking your HIV medications as prescribed?

o	o	o	o	o	o	o	o	o	o
Not at all Confident									Totally Confident

How COMMITTED are you to taking your HIV medications as prescribed 100% of the time (taking the right doses, on time, and every day)?

o	o	o	o	o	o	o	o	o	o
Not at all Committed									Totally Committed

PROGRAM SATISFACTION QUESTIONNAIRE

INSTRUCTIONS

Please rate your level of agreement with each of the following statements to indicate your level of satisfaction with the program you just completed. Circle one response for each item that best represents your level of agreement.

1.	I would recommend this program to a friend.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
2.	The interview was thorough and complete.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
3.	The program seemed well-organized.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
4.	The program was not confrontational.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
5.	The program made me think about my adherence to HIV medications.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree
6.	I learned new things from the program.	Strongly Disagree	Disagree	Uncertain	Agree	Strongly Agree

7. What did you find *most useful* about the program?

8. What did you find *least useful* about the program?

APPPENDIX C
IRB Approval and Consent Form

Oklahoma State University
Center for Health Sciences
College of Osteopathic Medicine

Institutional Review Board
FWA # 00005037

Memo

To: Thad Leffingwell Ph.D
OSU, Dept. of Psychology
116 North Murray
Stillwater, OK 74078

Cc: Kasey Claborn, M.S.
OSU Dept. of Psychology
116 North Murray
Stillwater, OK 74078

Johnny R. Stephens, Pharm. D.
OSU-CHS

From: Colony Fugate, D.O.
Vice-Chairman, Institutional Review Board

Date: November 23, 2010

Re: **Approval – Begin Study**
Protocol #2010022
Informed Consent Form, Version 11/21/10

Titled: **Electronic Intervention for HIV Medication Adherence**

Board members of the OSU-CHS, Institutional Review Board (IRB) reviewed and approved Protocol # 2010022 and Informed Consent Form, Version 11/21/10.

All investigators serving on the board were recused from voting on this matter.

It is your responsibility as principal investigator to report promptly serious adverse events and patient deaths to this IRB *whether or not they are directly related to the study protocol*. Additionally, if other study sites have SAE's that are reported to you, you must promptly provide them to the IRB. Any revisions or amendments to the approved protocol must be submitted to and approved by the IRB before implementation.

Principal investigators, collaborating investigators, study coordinators and other personnel who have contact with **data or subjects** involved in human research are required to receive **training on human subjects** using the CITI program. Instructions on how to complete the CITI training are located on page 4 in the Policy and Procedures Manual, accessible through Centernet.

You are free to begin the study once all persons involved with your study have completed the above-mentioned training and documentation of that training is received. This study is approved for 12 months. *An annual review for this Protocol will be due before November 20, 2011.*

If you plan to publish the results of your research, The International Committee of Medical Journal Editors (ICMJE) now requires trial registration at www.ClinicalTrials.gov as a condition for publication of research results.

The ICMJE's definition of a **clinical trial** is: "Any research project that prospectively assigns human subjects to intervention and comparison groups to study the cause-and-effect relationship between a medical intervention and a health outcome."

The ICMJE's definition of **medical intervention** is: "Any intervention used to modify a health outcome. This definition includes drugs, surgical procedures, devises, behavioral treatments, process-of-care changes, and the like."

YOU MUST REGISTER YOUR TRIAL BEFORE YOU RECRUIT ANY PARTICIPANTS. This registration includes retrospective chart reviews, but does not include single case studies.

As principal investigator of this protocol, it is your responsibility to insure that this study is conducted as approved. Any modifications to the protocol or consent form, initiated by your or by the sponsor, will require prior approval. All study records, including copies of signed consent forms, must be retained for three (3) years after termination of the study.

If you have questions please contact Bavette Miller, IRB Administrator at 918-561-1401 or bavette.miller@okstate.edu.

IRB # ____ Informed Consent

OKLAHOMA STATE UNIVERSITY
Center of Health Sciences
PATIENT INFORMATION AND CONSENT FORM

Title of Project: **Electronic Intervention for HIV Medication Adherence**

Investigator(s):
Thad R. Leffingwell, Ph.D.
Associate Professor
Department of Psychology
(405) 744-7494

Kasey R. Claborn, M.S.
Graduate Student
Department of Psychology
(806) 790-7950

Johnny R. Stephens, Pharm. D.
Associate Professor
Department of Internal Medicine
(918) 382-3527

You are being asked to take part in a research study. If this consent form contains any words you do not understand, please ask your doctor or the staff to explain these words so that you understand them. This consent form contains important facts to help you decide if it is in your best interest to take part in this study.

Purpose of the Study
The purpose of this study is to evaluate a computer-based intervention designed to improve medication adherence and clinical outcomes among individuals with HIV. You are invited to participate in this study because you are over the age of 18, have been diagnosed with HIV, and currently prescribed a highly active antiretroviral (HAART) medication regimen.

Approximately 100 participants will be involved in the study.

Description of the Study
Participants in this study will be randomly assigned into two groups using a computer-generated number. Participants will be asked to complete questionnaires for about 20-30 minutes on four separate occasions. The first set of questionnaires will be completed in the clinic. Approximately half of study participants will also be asked to watch a computer program that will take approximately 35 minutes. Approximately 50 participants will be randomly assigned to the intervention condition and 50 will be assigned to "treatment-as-usual." The remaining follow-up questionnaires will be completed on the phone at 1-month, 3-months, and 6-months after you have completed the first set of questionnaires. Questionnaires will ask you general questions about your background and will also ask you about your HIV medications and medication adherence related behaviors. You will not put your name on it, nor will there be any identifying marks on it, so that the investigators and your doctor will not know that you were the person filling out this particular questionnaire. If you decide you don't want to be in the study, you will inform the researcher.

Risks
Some people may experience some discomfort when responding to questions about their use of HIV medications. Participation in this study may also cause some people to reflect on important life choices and experiences. Information about professional services available to you in the community will be made available upon request.

Benefits
There is no proven medical or other benefit to you as a result of this study. Even though there is no known benefit, you and others may benefit in the future from what is learned in this study.

OSU - CHS
IRB

NOV 21 2010

APPROVED

Compensation
You will earn an entry into a lottery drawing for a personal portable DVD player for completing the initial session (approximate odds of winning are 1:100). Additionally, you will receive $5 after completion of each of the three follow-up assessments.

Alternative to Participation
The alternative is not to participate. Your participation is completely voluntary. There is no penalty for choosing to not participate. You may choose to not participate now, or at any time during your participation. **Your medical care in this clinic will not be affected by a decision to not participate or by withdrawing from the study at any time.**

By signing this form, you agree to allow the use and disclosure of your medical information for the purposes described above. **The information you authorize may include records which may indicate the presence of a communicable or noncommunicable disease**. With this knowledge you authorize and consent to the use and disclosure of information as described in this document to the people identified in this form. A copy of this authorization form will be given to you.

Your participation in this research study is voluntary. You are free to refuse to participate in any procedure and to refuse to answer any question at any time, and are free to withdraw your consent, and to withdraw from the research at any time without penalty.

If you have any questions or need to report an effect about the research procedures, you may call __Thad R. Leffingwell, Ph.D. at (405) 744-7494 for assistance or advice. If you have any questions about your rights while in this research study, please contact Dr. Paul Rock at (918) 828-4066.

By agreeing to participate in this research and signing this form, you do not waive any of your legal rights, nor is the investigator(s), sponsor, the institution or its agents free from liability for negligence.

"I have read and been given information about this research study and the risks involved have been explained to me. Any questions I may have had were answered to my satisfaction and I have been told who to contact should additional questions arise. As a result, I give my consent to participate in this research. I will receive a copy of this consent form."

_____	_____
Participant Signature	Date
_____	_____
Investigator	Date
_____	_____
Witness	Date

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NOV 20 2011

EXPIRES

Version 11/21/10

Patient's Initials _____

APPPENDIX D
Clinical Trial Protocol

Research Protocol

Title: *Electronic Intervention for HIV Medication Adherence*

Investigators:

Thad R. Leffingwell, Ph.D., Oklahoma State University, Department of Psychology

Kasey R. Claborn, M.S., Oklahoma State University, Department of Psychology

Johnny R. Stephens, Pharm. D., Oklahoma State University-Center for Health Sciences, Department of Internal Medicine

A. Specific Aims

Non-adherence to prescribed medication regimens among HIV patients is a serious public health concern. Unlike other chronic illnesses, effective HIV treatment requires stringent adherence rate of 95% or better to maximize the chances of treatment success and reduce the likelihood of developing drug resistant strains of HIV. Rates of non-adherence range from 31-70% among patients with HIV and tend to decline over time.(Ickovics, et al., 2002; Johnson, et al., 2003; Paterson, et al., 2000) Recent developments in intervention have found targeted intervention efforts using cognitive behavior therapy and motivational interviewing techniques to be effective at increasing adherence rates among patients with HIV(Parsons, et al., 2007). The effects of these interventions have proven superior to the long-standing educational and self-monitoring approaches.(Julius, et al., 2009)

Although the development of effective interventions is a promising step, several practical barriers limit the likelihood of widespread dissemination and adoption of these methods. Intervention approaches that are delivered by clinical staff place additional time and expense burdens on health care systems and professionals that are already under heavy demands of patient care. To provide ideal interventions with fidelity to evidence-based approaches, additional burdens of training and supervision are necessary. Electronic, computer-based interventions could overcome these barriers and aid dissemination of an efficacious, cost-effective, and high-fidelity intervention in the clinic setting. The specific aims of the proposed project are:

1. Develop an innovative computer-based electronic adaptation of the evidence-based *Life Steps* program to enhance HIV medication adherence.
2. Evaluate the efficacy of the electronic intervention to enhance medication adherence among individuals with HIV via a randomized controlled trial.

By achieving these aims, the project will develop and rigorously test the efficacy of an intervention modality that will address the problem of nonadherence in an efficient and cost-effective way.

B. Research Design and Methods

The electronic intervention will be developed and pilot tested. We will assemble a battery of measures and plan the intervention, including creating a script for the "electronic interviewers" to use in guiding the participant through the intervention. The script for the interviewers will be developed based upon the empirically validated *Life-Steps* program[6], and will strive to adhere as closely as possible to what would be expected of a live interviewer with expertise in the technique. The intervention itself will be developed using Adobe Presenter software, an off-the-shelf development application commonly used to produce distance education and training applications. This software allows for presenting the intervention in an engaging, interactive and navigable way, while also allowing for testing participant comprehension via embedded quizzes. The "electronic interviewer" will participate in the *Life-Steps* program process by walking the participant through each step, and providing explanatory and motivational commentary.

In addition to the computer-based information, we will prepare a user-journal that each participant will use in conjunction with the program. The journal will include worksheets and written resources to supplement the computer information and provide the user with some written materials for the participant to retain after the computer interaction. The journal will also include a copy of the *Life Steps* program on a compact disc for subsequent review by the participant if needed.

Consistent with the original *Life-Steps* intervention, the assessment intervention itself will include 10 informational, problem-solving, and cognitive behavioral steps, each presented as a separate module. Completion of one module will direct the participant directly to the subsequent module. The modules are as follows:

Step 1: Education and Introduction. This module will provide information about the critical role medication adherence plays in successful treatment. An understandable rationale for the medication regimen and adherence to the regimen will be provided. The aim of the education component is to increase knowledge and a sense of self-efficacy to influence their HIV treatment success. Patients will be reminded that, unlike other medications, antiretroviral medications are taken to prevent the occurrence of certain symptoms; however, they may cause negative side effects. Motivation for taking pills as recommended will be discussed in reference to the goal of blocking viral replication, reducing viral load, and preventing drug-resistant strains of HIV from emerging. This information will be supplemented with animated illustrations. The introduction will address two primary goals: (a) promote the perspective that the pills are health-protecting tools; and (b) introduce problem-solving for medication adherence.

Step 2: Transportation to Appointments. This module involves problem-solving strategies and rehearsal techniques. The aim of this module is to address transportation issues in advance so patients will not miss important appointments with their health care providers. Further, brief cognitive-restructuring and problem-solving approaches can be employed for cognitive distortions regarding the reactions of other people (i.e., coworkers, classmates, friends and family) to their recurrent appointments.

Step 3: Obtaining Medications. Patients will develop a plan for continued access to medications, including payment, selection of a pharmacy, and back-up plans. This module will also address concerns regarding patient's privacy and confidentiality with the pharmacist.

Step 4: Communicating with Physicians, Nurses, and Other Members of the Treatment Team. Patients with HIV are frequently embarrassed about asking providers health-related questions. An example of an interaction between a patient and provider will be provided via a brief video. Brief cognitive techniques will be suggested for irrational fears about asking questions.

Step 5: Coping with Side-Effects. In this module participants are asked to (a) help themselves pick a regimen collaboratively with their doctor to minimize side effects; (b) re-interpret the initial side effects as signs that the medications are in their bloodstream and working; (c) increase the salience of the reasons for taking medications despite the side effects.

Step 6: Formulating a Daily Medication Schedule. The goal of this module is for the patient to complete a detailed map of an average day of pill-taking, specifying environmental and other cues for pill-taking throughout the day. The participant will focus on linking medication doses to regular activities, disentangle a complex regimen (i.e., food restrictions with doses), and identify specific times that are potential risks for missing doses. The user-journal will include worksheets to develop a personalized daily medication schedule.

Step 7: Storing Medications. In addition to complex schedules, many HIV regimens require some medications to be refrigerated which may pose a problem for patients when they are not at home. This module focuses on problem-solving techniques and discusses additional interventions for storing medications including pill boxes or zip-lock bags marked with appropriate time, food restriction, and refrigeration information.

Step 8: Cues for Pill-Taking. The user-journals will include a set of colored adhesive dots. This module illustrates how to use these dots as a cue for pill taking by placing them in various spots (i.e., bathroom mirror, computer at work, the receiver of a telephone) where they will see them. These dots are used as a cue for pill taking and to rehearse adaptive cognitions for adherence (i.e., "by taking my pills on time I have done my part to take care of my body"). Additionally, overt reminders such as linking pill taking with waking up and going to bed or setting alarms are discussed.

Step 9: Responses to Slips in Adherence. It is likely that at some point, the patient will miss a dosage. This module teaches patients how to handle slips and to avoid all-or-nothing thoughts. This module introduces cognitive techniques to convey the view that, although the goal is to maintain perfect adherence, if a lapse occurs, the best choice is to return to the regimen as soon as possible.

Step 10: Review of Procedures. To help patients remember the strategies discussed, this module reviews the previous steps and provides feedback to the client regarding any action items such as questions to ask the physician, purchasing a refrigerator bag or pill box, purchasing an alarm watch, or placing the colored dots.

Evaluation Methodology

We will implement a randomized trial with HIV patients who are either new patients or at-risk for nonadherence to investigate the effectiveness of the new intervention. Patients with HIV who currently are prescribed an antiretroviral medication regimen will be recruited through the Internal Medicine Specialty Services which is an outpatient clinic through Oklahoma State University Center for Health Sciences that serves primarily patients living with HIV. To be included in the study, patients must be (a) infected with HIV, (b) over the age of 18, (c) currently prescribed a Highly Active Antiretroviral Therapy (HAART) regimen, regimen for the first time, changing regimens, or report adherence below 95%, and (d) agree to three brief follow-up interviews over the course of one year. Participants will be excluded from the study if they present with a physical impairment that would prevent them from successfully completing the computer-based program (e.g., blind, deaf); however, if an individual with these impairments presents for the study, the authors will adapt the computer-based program to meet the needs of the individual (i.e., add captions to the program for someone who is deaf) and allow them to complete the program. Additionally, potential participants who report being actively psychotic will be ineligible from the study. Participants who meet the screening criteria will be randomly assigned (by computer generated number) to one of the following conditions: (1) Treatment as usual (TAU; $N = 50$) or (2) TAU + *Life Steps* electronic intervention ($N = 50$). We estimate completion of the intervention to take approximately 35-45 minutes.

Immediately after providing written consent to participate in the study, participants will complete a brief questionnaire (see Appendix C) including six measures assessing demographic information, adherence to HIV medications (AACTG Medication Adherence Questionnaire), self-efficacy to adhere to HIV regimen (HIV Treatment Adherence Self-Efficacy Scale), commitment to adhere to HIV regimen, quality of life (McGill Quality of Life Questionnaire), and intervention satisfaction (The Program Satisfaction Questionnaire).

Demographics Questionnaire. Information regarding gender, age, and ethnicity will be gathered using the demographics questionnaire. Additional information regarding the participants' current living situation, marital status, sexual orientation, and educational attainment will also be collected.

AACTG Medication Adherence Questionnaire. Self-reported adherence to HIV medications will be assessed using the AACTG Medication Adherence Questionnaire (M. A. Chesney, et al., 2000). This instrument was developed by the Adult AIDS Clinical Trials Group (AACTG) and is a five-item self-report measure that has been used extensively in the United States and internationally to assess adherence to antiretroviral medications (Reynolds, et al., 2007). This measure queries patients on the number of doses he or she has missed of each medication during each of the last four days. Additionally, other adherence behaviors are assessed such as following specified instructions, missing doses on the weekend, and how closely the patient followed the specific schedule. The AACT Medication Adherence Questionnaire has demonstrated good reliability (Cronbach's alpha = .80).

HIV Treatment Adherence Self-Efficacy Scale (HIV-ASES). Self-efficacy for adherence to HIV medications will be assessed using the HIV-ASES (Johnson, et al., 2007). The HIV-ASES is a 12-item scale of patient confidence in their ability to carry out behaviors related to adhering to medication regimens. Responses range from 1 ("cannot do it at all") to 10 ("completely certain can do it." Item scores are averaged with higher scores indicating higher adherence self-efficacy. Analysis of the HIV-ASES has revealed robust internal consistency (.90) and reliability (.91).

Commitment to Adhere to HIV Medication Regimens. This item was developed for the purposes of this study and consists of a single question addressing the participant's level of commitment to adhere to the currently prescribed antiretroviral medication regimen. Responses range from 0 ("not committed at all") to 10 ("completely committed") with high scores demonstrating higher levels of commitment to adherence.

HIV Medication Readiness Scale (HMRS). Readiness to successfully start and adhere to HIV medications will be assessed using the HIV Medication Readiness Scale (Balfour et al., 2007). The HMRS is a brief 10-item questionnaire that assesses the level of readiness and likelihood of adhering to medications in people living with HIV. This measure has demonstrated high internal consistency (*alpha*=.90) and test-retest reliability (*r*=.83).

McGill Quality of Life (MQOL). Quality of life will be assessed using the McGill Quality of Life questionnaire (Cohen, et al., 1996). This instrument is a 16-item scale that assesses quality of life in four domains: physical well-being, psychological well-being, existential well-being, and support; each item is assessed on a 0-10 point scale. The MQOL has been widely used in research for people with life- threatening illnesses and has been translated and validated in a variety of languages. The MQOL has demonstrated good internal validity (0.74-0.92) and test-retest reliability (0.70) (Cohen, et al., 1997).

Simple Screening Instrument for AOD Abuse (SSI-AOD). The Simple Screening Instrument for AOD abuse (Winters & Zenilman, 1994) will be used to assess alcohol and other drug use within the previous 6 months. The SSI-AOD is a 16-item self-report measure consisting of 16 dichotomous (yes/no) items. Domains measured by the instrument include: (1) alcohol and other drug consumption; (2) preoccupation and loss of control; (3) adverse

consequences; (4) problem recognition; and (5) tolerance and withdrawal. The SSI-AOD has demonstrated good test-retest reliability (r = .90).

Center for Epidemiologic Studies Depression Scale (CES-D). The Center for Epidemiologic Studies Depression Scale (CES-D; Radloff, 1977) is a brief, 20-item self-report instrument that measures the presence and severity of symptoms of depression in the general population. Responses for each of the items are on a Leikert scale from 0, "rarely or none of the time" to 3, "most or all of the time." Responses are summed to obtain total scores from 0 to 60. Scores of 16 or above indicate high depressive symptoms without a clinical diagnosis. The CES-D has demonstrated high internal consistency (α = .85) in a general population sample and even higher internal consistency (α = .90) in a patient sample (Radloff, 1977). It also has demonstrated good concurrent validity (r = .51 to .61) with scales designed to measure symptoms of depression. This measure will be included to assess symptoms of depression.

Clinical outcomes. Medical records for each subject will be reviewed for the most recent laboratory test results of CD4+ cell counts, viral load, and occurrence of opportunistic infections. These records will be reviewed three weeks after baseline assessment and within two weeks after each follow-up point. This time frame will allow the investigators to access the most recent clinical data relevant to the time point.

Program Satisfaction Questionnaire. This questionnaire was developed for the purposes of this study to address the level of satisfaction with the intervention. This questionnaire consists of eight items assessing level of agreement or disagreement with the statement, such as "I would recommend this program to a friend" and "I learned new things from the program."

At one, three, and six months, participants will be re-contacted in person at regularly scheduled clinic visits or via telephone and will complete a brief interview to indicate their current levels of adherence and problems experienced in the last month. Each interview should take approximately 20 minutes. Participation in this research study is voluntary. The participant is free to refuse to participate in any procedure and to refuse to answer any question at any time, and is free to withdraw his or her consent, and to withdraw from the research at any time without penalty.

Given the sensitive nature of the information being collected in this study, special precautions are planned to help ensure anonymity for all participants. First, a random, unique subject identification number will be created for each participant in the study. A key connecting all of the identification numbers with participant names will be maintained on a secure list, separate from any participant data, and stored in a locked filing cabinet in a locked room to which only members of the research team will have access. Second, all records from this study will be kept confidential to the extent allowable by law, and several measures will be taken to minimize the likelihood that this confidentiality will be compromised. Computerized data will be maintained on a password-protected computer in a password-protected file accessible only by members of the research team. Results of this study will be reported in aggregate form. In other words, no individual data will be reported. It is possible that the consent processes and data

collection will be observed by research oversight staff responsible for safeguarding the rights and wellbeing of people who participate in research. All non-computerized records will be kept in a locked filing cabinet in a locked room separate from any identifying information.

There are several potential risks from participating in this study. First, some people may experience some minor temporary emotional discomfort when responding to questions about their use of HIV medications. Participation in this study may also cause some people to reflect on important life choices and experiences. Information about professional services available to the participant in the community will be made available upon request in addition to the support and assistance already available to every patient within the clinic. Additionally, potential benefits from participating in this study need to be acknowledged. First, many participants learn important information about themselves and their behavior related to taking anti-HIV medications as a result of involvement in research that may help them to make decisions to reduce their risk for developing strands of HIV that do not respond to treatment and improve their health.

Participants in this study will be compensated for completion of each assessment point. Participants will be entered in a lottery to win a portable DVD player for completing the initial session and will receive $5 for completing each of three follow-up interviews for a total of $15 at the end of the study.

The effects of the intervention will be evaluated using a number of statistical analyses, described as follows by hypothesis:

1. *Participants in the Life Steps electronic intervention condition will report high satisfaction with the intervention.*

   Means and standard deviations for a participant satisfaction measure will be evaluated and compared to the scale anchors to determine if the level of satisfaction is relatively high or low.

2. *Participants in the Life Steps program will report higher self-efficacy and commitment to maintain adherence to their medical regimens as compared to those in the TAU condition.*

   Immediate post-intervention scores on measures of self-efficacy for treatment adherence and commitment to adherence will be calculated for all participants. Differences between groups will be evaluated with *t*-tests of the group means, assuming there are not significant differences in demographic variables at baseline. If significant demographic variables exist, they will be included as covariates in ANCOVA analyses of between group means.

3. *Participants in the Life Steps electronic intervention condition will demonstrate greater self-reported medication adherence than those in the TAU condition.*

Between-group differences in self-reported adherence will be evaluated at each follow-up time point with *t*-tests of group means (or ANCOVA if necessary, as above). Time × Treatment interaction effects in mixed model ANOVAs can also be evaluated to examine differences in patterns of change in adherence over time between the two groups.

4. *Participants in the Life Steps electronic intervention condition will demonstrate superior viral and immunologic outcomes (viral load and CD4 count) compared to those in the TAU condition.*

   Between-group differences in self-reported adherence will be evaluated at each follow-up time point with *t*-tests of group means (or ANCOVA if necessary, as above). Time × Treatment interaction effects in mixed model ANOVAs can also be evaluated to examine differences in patterns of change in adherence over time between the two groups.

Statistical Power and Estimated Sample Size

We estimated our sample size based upon expectations of patient flow in our partner clinic. Based upon this sample size (n=100), we utilized the G*Power program to estimate the size of effect we should be able to detect at $\alpha = .05$ and statistical power of at least .80. With a sample size of 100, our study should be able to reliably detect an effect size of .57, or a moderate effect. An effect of this size (a little more than one half of a standard deviation difference) would be large enough to be clinically meaningful as well.

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APPPENDIX E
Additional Analyses with Alternative Missing Data Options

Additional Analyses with Alternative Missing Data Options

Missing data is a common problem in HIV clinical trials. In this study the attrition rate from baseline to one-month follow-up was 25% which is within the expected range for clinical trials with this population (Amico, Harman, & O'Grady, 2009). Excluding participants who fail to complete the entire study, however, may yield biased results. A variety of methods can be used to analyze outcomes with missing data points. In addition to using regression imputation as cited in the above manuscript, analyses were also conducted using the last observation carried forward and mean imputation methods. Further, analyses were examined excluding participants who did not complete the study (non-completers). Results and conclusions from each of the analytical methods are discussed.

Primary Analyses Utilizing the Last Observation Carried Forward Method

The last observation carried forward (LOCF) method of handling missing data points imputes values based on the existing data. This method has been widely used in longitudinal clinical trials; however, recent literature suggests that it provides biased estimates of potential effects of the treatment. Several advantages to using this method include: (1) minimization of participants excluded from analyses; and (2) allow examination of trends over time from baseline to follow-up.

Treatment Self-Efficacy

Immediate post-intervention scores on the measure of self-efficacy (HIV-ASES) for treatment adherence were calculated for all participants. For those who were missing data points at one-month follow-up, baseline data for each participant was carried forward and included as

that participant's one-month follow-up data point. Time × Condition interaction effects in mixed model ANOVAs were examined and failed to demonstrate a significant difference between the two conditions $F(1, 87) = 2.93$, $p = .09$, $\eta^2 = .03$. Between-group differences in self-efficacy were evaluated at the one-month follow-up time point with *t*-tests of group means. Results failed to reach significance $t(87) = 1.63$, $p = .11$. Based on the LOCF method of analysis, these results suggest the intervention did not have a significant effect on self-efficacy at one-month follow-up.

Adherence

Adherence scores were calculated for all participants using self-reported 4-day recall data. For those who were missing data points at one-month follow-up, baseline data for each participant was imputed for that participant's one-month follow-up data point. Time × Condition interaction effects in mixed model ANOVAs were evaluated to examine differences in patterns of change in adherence over time between the two groups. Although approaching significance, the interaction term failed to demonstrate a statistically significant difference in the pattern of change in adherence over time between conditions $F(1, 92) = 3.47$, $p = .07$, $\eta^2 = .04$. Between-group differences in adherence were evaluated at baseline and one-month follow-up with *t*-tests of group means. There was a significant difference in adherence levels between the two conditions at baseline, $t(92) = -2.16$, $p = .03$, with the TAU group ($M = 80.81$, $SD = 26.41$) reporting significantly greater levels of adherence than the *eLifeSteps* group ($M = 67.20$, $SD = 34.29$). Results from the *t*-test at one-month follow-up failed to demonstrate a significant difference between conditions, $t(93) = -0.87$, $p = .39$. These results demonstrated a trend in improved adherence over time among participants in the *eLifeSteps* condition, while participants

in the TAU condition remained consistent between baseline and follow-up (see Table 6 for group means and standard deviations by time point).

Primary Analyses Utilizing the Mean Imputation Method

Treatment Self-Efficacy

Immediate post-intervention scores on the measure of self-efficacy (HIV-ASES) for treatment adherence were calculated for all participants. For those who were missing data points at one-month follow-up, group means at baseline were calculated and imputed for that participant's one-month follow-up data point. Time × Condition interaction effects in mixed model ANOVAs were examined and demonstrated a significant difference between the two conditions $F(1, 87) = 6.91$, $p = .01$, $\eta^2 = .07$ with participants in the *eLifeSteps* condition reporting higher scores of self-efficacy to adhere to their HIV treatment regimen ($M = 8.89$, $SD = 1.25$) compared to the TAU participants ($M = 7.89$, $SD = 1.63$) at 1-month follow-up. Between-group differences in adherence were evaluated at baseline and one-month follow-up with *t*-tests of group means. Results for self-efficacy at baseline failed to reach significance, $t(87) = 1.48$, $p = .14$; however, there was a significant difference between groups at 1-month follow-up, $t(87) = 3.22$, $p = .002$. This suggests that, on average, participants who completed the *eLifeSteps* intervention demonstrated an increase in belief to adhere to the prescribed HIV medication regimen between baseline assessment and 1-month follow-up, while participants in the TAU condition remained constant.

Adherence

Adherence scores were calculated for all participants using self-reported 4-day recall data. For those who were missing data points at one-month follow-up, group means at baseline were calculated and imputed for that participant's one-month follow-up data point. Time × Condition interaction effects in mixed model ANOVAs were evaluated to examine differences in patterns of change in adherence over time and demonstrated a statistically significant difference between conditions $F(1, 92) = 4.13$, p=.045, η^2=.04. Between-group differences in adherence were evaluated at baseline and one-month follow-up with *t*-tests of group means. There was a significant difference in adherence levels between the two conditions at baseline, $t(92) = -2.16$, $p = .03$. Results from the *t*-test at one-month follow-up failed to demonstrate a significant difference between conditions, $t(93) = -0.82$, $p = .42$. These results are consistent with the regression imputation and LOCF results.

Primary Analyses Excluding Non-Completers

Treatment Self-Efficacy

The last observation carried forward, regression imputation, and mean imputation methods resulted in a sample size of ninety-five. Since excluding non-completers omits participants from the analyses, the sample size for the following analyses resulted in sixty-eight participants. Immediate post-intervention scores on the measure of self-efficacy (HIV-ASES) for treatment adherence were calculated for all participants who completed both baseline and follow-up assessment points. Time × Condition interaction effects in mixed model ANOVAs were examined and demonstrated a significant difference between the two conditions $F(1, 65) = 6.78$, $p = .01$, η^2=.09. Between-group differences in adherence were evaluated at baseline and 1-month follow-up with *t*-tests of group means. Results demonstrated a significant difference between

groups at baseline, $t(70) = 2.07$, $p = .04$ Participants in the *eLifeSteps* condition reported higher scores of self-efficacy to adhere to their HIV treatment regimen compared to the TAU participants at baseline and 1-month follow-up (see Table 6 for means and standard deviations).

Adherence

Time × Condition interaction effects in mixed model ANOVAs were also evaluated to examine differences in patterns of change in adherence over time and failed to reach a statistically significant interaction $F(1, 66) = 1.26$, $p = 0.27$, $\eta^2=.02$. Between-group differences in adherence were evaluated at baseline and 1-month follow-up with *t*-tests of group means. Both tests failed to reach significance at baseline, $t(71) = -1.37$, $p = .18$, and at 1-month follow-up $t(67) = 0.01$, $p = .99$.

Conclusions from the Various Methods of Handling Missing Data

Discrepancies in Outcomes by Method

Results from the analyses utilizing the mean imputation [$F(1, 87) = 6.91$, $p = .01$, $\eta^2=.07$] and regression imputation [$F(1, 87) = 4.70$, $p<.05$, $\eta^2=.05$] methods revealed significant differences between conditions in regards to HIV treatment self-efficacy (see Table 7). The last observation carried forward (LOCF) method, however, failed to reach significance, $F(1, 87) = 2.93$, $p = .09$, $\eta^2=.03$. A similar pattern of results was identified in regards to the adherence variable. The mean imputation [$F(1, 92) = 4.13$, $p=.045$, $\eta^2=.04$] and regression imputation [$F(1, 92) = 3.75$, $p=.056$, $\eta^2=.04$] methods revealed results that approached significance. The LOCF method was nonsignificant, $F(1, 92) = 3.47$, $p=.07$, $\eta^2=.04$.

Conclusions

The LOCF method provides conservative results; however, it is problematic when participants drop-out of the study early in the trial and when responses are expected to change over time (Myers, 2000). Considering that this study only utilizes two data points (baseline and 1-month follow-up) and change is expected to occur over time, use of the LOCF method likely underestimating the effect of the intervention. The LOCF approach has been a common method used in handling missing data in clinical trials for decades; however, recent literature supports that this method is not ideal (Mallinckrodt, et al., 2003; Kenward, M. & Molenberghs, 2009). Additionally, the mean imputation method may distort the distribution of the variable measured. With these consideration in mind, it was determined that the use of regression imputation would be the best estimate of the missing variables.

Table 6 Primary analyses excluding non-completers

Primary Outcome	eLifeSteps		TAU			
Measure	*M*	*SD*	*M*	*SD*	*F*	*p*
HIV Self-Efficacy					6.78	.012
Baseline	8.67	1.68	7.79	1.92		
Follow-up	8.91	1.39	7.96	1.81		
Adherence					1.26	.27
Baseline	67.06	34.96	79.35	28.14		
Follow-up	80.47	30.28	81.94	27.78		

Table 7 Primary outcomes as a function of analytical method

Analytic Strategy	Primary Outcome Measure	eLifeSteps		TAU		*F*	*p*
		M	*SD*	*M*	*SD*		
Last Observation Carried Forward							
	HIV Self-Efficacy					2.93	.09
	Baseline	8.46	1.77	7.88	1.90		
	Follow-up	8.60	1.59	8.00	1.82		
	Adherence					3.47	.07
	Baseline	67.20	34.29	80.81	26.41		
	Follow-up	76.33	31.73	82.80	26.03		
Mean Imputation							
	HIV Self-Efficacy					6.91	.01
	Baseline	8.46	1.77	7.88	1.90		
	Follow-up	8.90	1.25	7.89	1.63		
	Adherence					4.13	.045
	Baseline	67.20	34.29	80.81	26.41		
	Follow-up	76.23	25.63	81.68	24.24		
Regression Imputation							
	HIV Self-Efficacy					4.70	.03
	Baseline	8.46	1.77	7.88	1.90		
	Follow-up	8.77	1.34	7.96	1.67		
	Adherence					3.75	.056
	Baseline	67.20	34.29	80.81	26.41		
	Follow-up	80.53	26.29	81.40	25.21		

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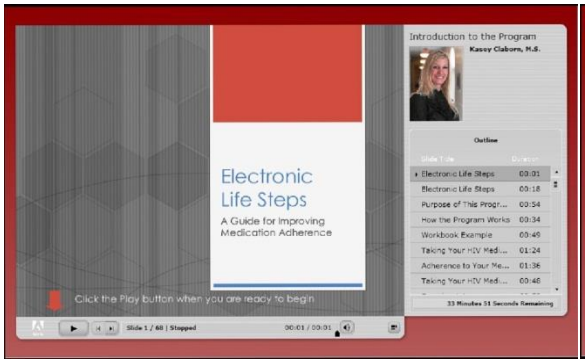
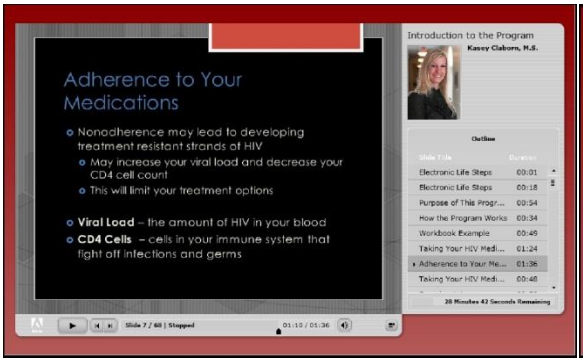
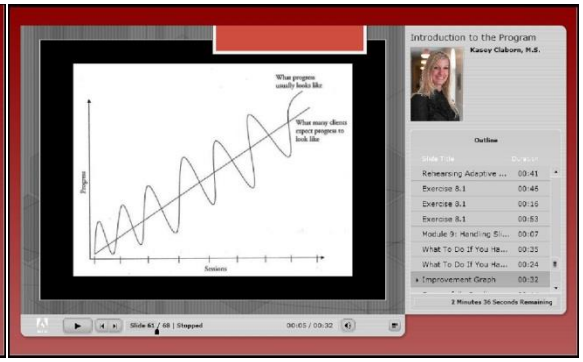
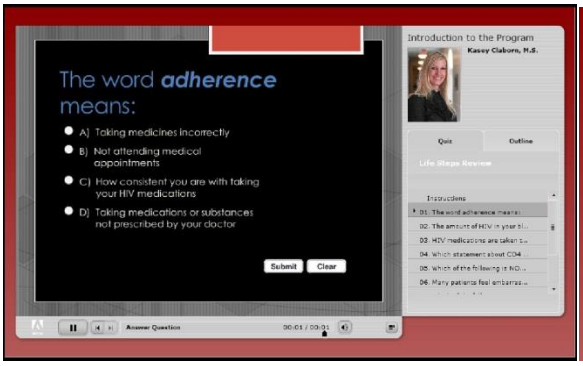
APPPENDIX F
Screenshots of the Electronic Life Steps Program


Introduction to the Program
Kasey Claborn, M.S.
Electronic Life Steps
A Guide for Improving Medication Adherence
Click the Play button when you are ready to begin


Introduction to the Program
Kasey Claborn, M.S.
Adherence to Your Medications
Nonadherence may lead to developing treatment resistant strands of HIV
May increase your viral load and decrease your CD4 cell count
This will limit your treatment options
Viral Load – the amount of HIV in your blood
CD4 Cells – cells in your immune system that fight off infections and germs


Introduction to the Program
Kasey Claborn, M.S.
Adherence to Your Medications
Nonadherence may lead to developing treatment resistant strands of HIV
May increase your viral load and decrease your CD4 cell count
This will limit your treatment options
Viral Load – the amount of HIV in your blood
CD4 Cells – cells in your immune system that fight off infections and germs


Introduction to the Program
Kasey Claborn, M.S.
What progress usually looks like
What many clients expect progress to look like
Progress
Sessions


Introduction to the Program
Kasey Claborn, M.S.
The word adherence means:
A) Taking medicines incorrectly
B) Not attending medical appointments
C) How consistent you are with taking your HIV medications
D) Taking medications or substances not prescribed by your doctor
Submit
Clear


Reminder Cues
Place round-colored adhesive stickers around your home or work to serve as reminders

APPPENDIX G
Protocol Scripts

Module 1: Education and Introduction

(Slide 1) Welcome to the Electronic Life Steps program. My name is Kasey and I will be guiding you through each step in the program. This program will give you tools to help fight against HIV and be healthier. We will focus on learning skills to help you take your medications as prescribed by your doctor. (click)

(Slide 2) HIV medications help many people manage their HIV and live longer, healthier lives. Unfortunately, these medications don't work if you do not take them properly and for the long-term. This program will teach you valuable skills that will help you incorporate your HIV medications into your daily life. Throughout this program we will use the term (click) "medication adherence" to refer to how consistent you are with taking your HIV medications as prescribed by your doctor. Adherence includes taking the correct doses of your medications every time you are supposed to take them.

In order for your medications to work properly, you need to take your medications exactly as they are prescribed. This can be challenging since taking HIV medications is a daily, lifelong treatment. (click) Inaccurate use of your medications, or nonadherence, (click) includes taking drug holidays, (click) taking medications incorrectly, (click) when a person stops taking his or her medications, (click) using treatments or substances not prescribed by your doctor, (click) and not attending medical appointments. All of these behaviors may result in severe consequences for your health and quality of life. (click)

(Slide 3) Only taking medications properly some of the time may result in the development of treatment resistant strands of HIV. (click) This means that your body has become resistant to the medication you are taking and that medication will stop working. (click) This may result in an increase in your viral load and a decrease in your CD4 cell count and you will likely have to change to a different medication. (click) The term "viral load" refers to the amount of HIV in your blood. The higher the amount of HIV in your bloodstream, the more at risk you are at for having damage to your immune system. Your immune system fights germs and infections. (click) The immune system is made up of white blood cells which are also called CD4 cells. HIV destroys CD4 cells and causes the immune system to become weak and unable to fight off infections and germs.

This can result in you getting infections that can cause serious illness or even death.

In order for you to keep your CD4 count high and your immune system functioning properly; it is very important that you follow the directions your doctor gave you about when and how to take your HIV medications. Medication adherence is a skill that you learn. You will learn different skills in this program to help you maintain a high level of adherence to your HIV medications. (click)

It is important to understand that pill taking for HIV medications may be different from other pill-taking behaviors. (click) With many conditions, such as headaches, the occurrence of symptoms serves as a reminder to take medication. For instance, when you have a headache, you decide to take medication to get rid of the headache. The symptoms of the headache reminded you to take the medication. This is not the case with HIV.

(click) With HIV, medications are taken to prevent the occurrence of certain symptoms, but may cause side effects. Throughout this session, we will develop reminders to take pills on schedule and learn how to deal with the side effects that you may experience. (click)

(Slide 5) The purpose of this program is to help you effectively follow the medical regimen prescribed by your doctor. (click) This program will teach you skills to help you manage your HIV medications and (click) improve your ability to be consistent with taking your medications long-term. This is important for two reasons. First, making sure that you're doing everything you can to manage your HIV is the best way to keep you physically healthy. Second, if you have a plan and the skills needed to put that plan into practice, you will feel less overwhelmed by your self-care regimen. In the following modules you will learn problem-solving strategies to help you overcome barriers that may cause you to not adhere to your medication regimen. As you go through the program, you will complete exercises in the workbook that was given to you before you began this program.

(click) In your workbook, turn to page 1. You will see an exercise called "The Pros and Cons of Changing." Use this form to determine the benefits and the consequences of changing. You will also think about the benefits and consequences of not changing. It is important to emphasize that there are definitely pros of not changing such as being used to the way things are now and not changing to be more comfortable and maybe easier in the short-term. The cons of not changing, however, can mean that you do not get a chance to see whether some of these strategies will actually make a difference and improve your quality of life. Take some time now to think about the pros and cons of changing and write them down in each box. After you have completed the exercise click on the play button located at the bottom of the screen (click).

(Next slide) Now, turn to page 2 of your workbook. Rate your level of motivation on a scale of 1-10, with 1 representing no motivation at all and 10 representing high motivation. Remember to click on the play button to continue to the next section.

(Next slide) (click) Many people can feel overwhelmed when first confronted with the number of new things needed to manage a complicated medical regimen. Being able to manage your HIV doesn't have anything to do with what kind of person you are. (click) It's something that changes over time and depends on the skills and support you have to successfully carry out your regimen. (click) It can be a lot like learning to drive a car for the first time. First, you need to learn about all the steps and why they're important: how to hold the wheel, how much pressure to apply to the pedals, when to check your mirrors, and so forth. At first, each one of these steps requires a lot of concentration and effort. You have to specifically remember to do them, and make sure to focus your attention. After doing them repeatedly over time, they feel less and less like steps and more and more like automatic behaviors. As much as possible, we want to help you learn the skills necessary to manage your illness well enough so that you can incorporate them into your life in a way that makes them feel almost as automatic as those steps involved in driving

a car. (click) Learning the steps involved in managing your HIV and following through with them is the best way you can get to better health and quality of life. (click)

Part of this process involves the use of problem-solving skills. One part of problem solving involves defining the problem and breaking it down into steps. First, we are going to directly apply problem-solving to medication adherence. In problem-solving, the first thing needed is to define the problem and think about goals. So, that is where we will begin.

Before we start, turn to page 3 in your workbook. What thoughts do you have regarding adherence to your medical regimen? Write your thoughts down in the blanks provided. When you are finished remember to click the play button. (click)

What are some things that may get in the way of adhering to your regimen? (click)

When you look at your medications and supplies, what goes through your mind? (click)

What are your top five reasons for staying adherent and taking care of your HIV? (click)

Now, we are going to go through a checklist of problems that some people have with medical adherence. By completing the checklist, solving problems related to adherence, and continuing to practice, you can make successful adherence a part of your daily routine. (click)

We will use a tool called AIM to solve some of your adherence-related problems. (click) The first step in AIM is to articulate, or think about, the particular adherence goal. (click) The second step is to identify barriers to reaching your goal. (click) The final step is to make a plan to overcome the barriers, as well as to develop a backup plan.

Turn to page 4 of your workbook and use the Adherence Goals Worksheet provided to write down the self-care behaviors that are specific to you and your illness. Throughout the program, we will target these goals and develop plans for meeting them. Remember to click the play button once you have completed the worksheet. (click)

Module 2: Getting to Appointments

"This is the first of the steps that involve problem-solving strategies and rehearsal techniques. You will use these skills to help you identify ways that will help you get to your medical appointments. We will be using the AIM problem-solving technique described in the previous module. Please refer to page 5 in your workbook. (Click)

On page 5, write down your adherence goal regarding medical appointments on question number 1. (PAUSE) How often do you have medical appointments? (PAUSE) Where are your appointments located? After you have completed this question, click the play button to continue. (click)

Now identify potential barriers to making medical appointments and write them down on question number 2. What might cause you to miss appointments? (PAUSE) Does your schedule conflict with scheduling appointments? (PAUSE) Do you live very far away? (PAUSE) What might be some additional barriers?

An example of potential barriers may include having children and not being able to find child care the day that you have your appointment. Another barrier might be working during the hours when the clinic is open. (click)

Now, make a plan and a back-up plan and write it down for question number 3. How will you get to your appointments in case the weather is bad or you can't go the way you usually go? (PAUSE) Is there public transportation nearby or does the clinic have a medical van that can pick you up or would it be better to call and reschedule? (PAUSE) How can you schedule your appointments and make sure you remember them? (PAUSE)

Develop a back-up plan in case problems come up. For instance, you may choose to schedule appointments early in the morning or late in the afternoon, go during lunch hour, or you may choose to know the public transportation schedules in case your other transportation fails." Here's an example of a plan and back-up plan: I will schedule my appointments well in advance and arrange for child care. I will schedule appointments during my lunch hour at work so that I will be able to make the appointment. My back-up plan in case I do not have child care the day of my appointment is to take my kids to my friend, Suzy's house who lives down the street from me and has volunteered to help if the need arises. If she is unavailable, then I will call the clinic and reschedule my appointment."

Module 3: Communicating with Treatment Team

"Communication with your medical provider can be a key component of treatment success. Having HIV is a sensitive issue and many people feel embarrassed about asking questions of their health-care providers. Many patients have difficulty remembering questions to ask their provider, become nervous during medical visits, and forget information. This module will help you develop a plan for improving communication with your doctor or medical team. We will be using the worksheet on page 6 to help develop the plan. (click)

First, on question number 1, identify any questions or comments that you would like to ask or discuss with your medical provider. During your next visit with your doctor, what questions do you want to ask about your symptoms, medications, side effects, or recommended self-care behaviors, such as questions about diet and exercise? (click)

Second, what are some potential barriers to communication with your medical provider? Do you feel uncomfortable talking to your doctor? Do you feel that he or she is too busy to talk to you or do you tend to forget what you want to ask? What might cause you to not ask your doctor the questions that you have? (click)

Now make a plan and back-up plan. How will you remember the questions that you want to ask your doctor? It may be helpful to write down your questions on an index card to bring to the medical visit. There is an index card in the front pocket of your workbook that you can use for this."

Module 4: Coping with Side Effects

"If you are taking medication to manage your illness, you are no doubt experiencing some side effects. There are many potential solutions to side effects, but these solutions tend to vary across illnesses. In this module you will identify which side effects are most distressful to you. It is important that you always consult with your physician about ways to manage your side effects. Fortunately, in many cases, with adequate medication adherence, side effects decrease over time. However, when side effects occur, some people do not strictly follow their medication schedule and decrease their level of adherence. This can result in developing treatment resistant strands of HIV and cause the disease to progress faster. It is vital that you do not allow side effects to push you out of strictly adhering to your treatment regimen. (click)

Using the worksheet on page 7, write down any problems with adherence that may emerge due to side effects. What kinds of side effects do you experience? (PAUSE) Which of your medications do you think are causing the side effects?

Example: 'I experience headaches, nausea, and muscle aches.' (click)

Identify potential barriers and write them next to question number 2. Have your side effects gotten in the way of taking your medication? (PAUSE) What have you done about the side effects so far? (PAUSE) Have you been able to talk to your doctor about these side effects? (click)

Now make a plan and a back-up plan.

Example: 'I will talk to my doctor about these side effects to see what else can be done to help me, like give me other medications or changing these.'

Module 5: Obtaining Medications and Other Health-Related Products

Having a continued access to your medications is important for treatment success. If you have your medications mailed to your home, you need to remember to call the refills in at least 3 days early so you can be sure the medications arrive in time and you do not miss any doses.

This module will help you to develop a plan for continued access to medications, including payment, selection of a pharmacy, and back-up plans. It is important for you to work with your health care provider to develop a plan for continued access to medications or other health-related products. The plan should include information regarding payment options, pharmacy selection, back-up plans for transportation or other issues, and management of your interactions with the pharmacist. (click)

Using the worksheet on page 8, write down the adherence goal of always having a sufficient supply of medications and needed supplies. Where do you get your medications and medical supplies? (PAUSE) How do you pay for your medications and medical supplies? (PAUSE) How do you get to your pharmacy? (PAUSE) Have you ever run out of your medications or medical supplies? (PAUSE) When do you ask for a medication refill from your pharmacy? (PAUSE) When do you ask for a prescription refill from your doctor? (click)

Identify potential barriers. What might cause you to run out of your medications or other needed medical supplies? (PAUSE) What might get in the way of getting to your pharmacy? (PAUSE) What might get in the way of getting another prescription from your doctor? (click)

Now make a plan and a back-up plan. How will you get to your pharmacy? (PAUSE) If there is bad weather, how will you get to your pharmacy? (PAUSE) Can you set up a medication mail-in so that your medications can be mailed to you directly? (PAUSE) How can you make sure that you do not run out of your medications? (PAUSE) How can you make sure that you do not run out of prescription refills?"

Module 6: Formulating a Daily Medication Schedule

This module will help you devise ways of reminding yourself to take your medication. Complete the Medical Regimen Worksheet provided on page 9 of your workbook. A sample worksheet has been provided on page 10 for you to use as a model when filling out your own. The goal of completing this worksheet is to develop a detailed map of an average day of pill-taking, specifying environmental and other cues for pill-taking throughout the day, such as taking your medicine after you brush your teeth. The toothbrush is a cue in your environment to remind you to take you medications.

It may be helpful to use this worksheet for each day of the week or a weekday and a weekend. When completing the Medical Regimen Worksheet, be sure to take into account the ideal times and conditions for taking medications, such as during an empty stomach or with food."

It is important that you consider variations in a "typical" day. It is often times more challenging to remember to take medication on days when we do not have a routine, such as weekends, holidays, or vacations." (click)

Using the AIM technique and page 11 of your workbook, first, write down the adherence goal of remembering to take medications and follow your medical regimen. When do you take your medications? (PAUSE) How do you remember to take your medications? (click)

Next, identify potential barriers. When do you tend to forget to take your medications? (PAUSE) Identify specific times that are potential risks for missing doses such as weekends due to disruptions in routine. (PAUSE) Do you usually take your medications when you are doing something else? For instance, you may take your medication with your cup of coffee and toast in the morning or when you get home from work each day or during the nightly news. (PAUSE) What gets in the way of taking your medications regularly? (click)

Now make a plan and back-up plan. What activities can you do at the same time as you take your medication so that each time you do it, you will remember to take your medications too. Examples include during breakfast or with an afternoon snack. When would be the best times to schedule taking your medications? (PAUSE) How can you be sure to follow what you need to with respect to adhering to your medication regimen? (PAUSE) What if you forget to take your medications?

It's important to know your schedule for each day of the week and when you will take your medicine. Having a set time that you will take your medicine each day of the week will make it easier for you to remember to take your medicine.

Module 7: Storing Medications and Medical Supplies

"Now that you know your daily schedule, it is important to address the issue of storing the medications when you are not at home. Some medications require safe and portable storage or refrigeration. If this is the case with your medicines, we need to use problem-solving skills to address this issue. Please turn to page 12 of your workbook. (click)

"First, think about the adherence goal of properly storing your medications, even when you are not at home. You may wish to find private places to keep your medications to maintain confidentiality. If you leave home, do you take your medications with you if you know you will not be back in time for your dose? How do you carry your medications with you when you go out? Do you keep them in a pillbox or a bag? Remember to click the play button once you are ready to continue. (click)

"Identify potential barriers. Where do you keep your medications when you go out and bring then with you? (PAUSE) Do any of your medications need to be refrigerated? (PAUSE) What will you do about storing medications when you are away from home? (click)

"Now make a plan and back-up plan. If your medications need to be refrigerated, what can you do instead of storing your medications in work or others' refrigerators? Some people find that taking a refrigerated lunch bag with an ice pack is helpful.

"Take a look at your dose times again and see if you can take your doses in such a way that you will not have to worry about keeping your medication cold. For medications that retain their potency for a number of hours, you may be able to time the doses so that storage in a refrigerator is not necessary. Would you be able to buy and use a small Ziplock bag or a pillbox for each dose of the day? That way you can mark each bag with the appropriate time you are supposed to take your medications and any other things you need to remember about them, like certain foods to eat or not eat with them and refrigeration information. You may also consider keeping back-ups in your car trunk or glove compartment in case you forget to bring your medication with you one day."

Module 8: Cue-Control Strategies for Taking Medications

"In this module, you will learn strategies for remembering to take medications and for rehearsing adaptive thoughts of adherence each time you look at the cues." (click)

"In your folder are round, colored adhesive stickers. These stickers can be placed in or around your home or workplace as reminder cues. (click)

After placing the stickers in specific places such as on your bathroom mirror or on your computer at work, take one of the same stickers and place it on a note card. (click twice) Write on the note card a particular issue you want to be reminded of when you see the stickers elsewhere. For example, you may write, 'I am taking my medicine so I can be healthy for my loved ones.' Post the note card in a place where you will see it often, so that whenever you see the sticker in your home or at your job, you can remember what it stands for. This provides a link between the adaptive thoughts we identified in the first module and the dots in your environment."

"Now we are going to use the AIM technique to solve problems related to using these cue-control strategies. We will be using the problem solving worksheet 8.1 found on page 13 of your workbook. The first step is to write down the adherence goal of using strategies for improving your motivation to take medications and for remembering to take them. How do you usually help remind yourself to take medications? (PAUSE) What do you think about when you know it is time to take your medications? (LONG PAUSE). Once you have completed this question click the play button to continue.

Next, identify potential barriers. What things do you think may keep you from using dots? (PAUSE) Do you think the dots would be helpful reminders to take your medications? (LONG PAUSE)

Now, make a plan and a back-up plan. Where can you place each dot so that you can see it at each dosing time? For example, you may place a dot near a doorknob inside the house, near the lock outside the door, bathroom mirror, work computer, phone receiver, or any other helpful places. What other things do you think you can use to help you remember your medications? (PAUSE) For some people linking trips to the bathroom when you wake up and before going to bed help to serve as reminders. Other people may use pill boxes with built-in timer alarms, a wake-up call service, clocks or timers that chime on the hour or half-hour, or use computers or their cell phones to sound alarms at designated times reminding them to take their medications.

Module 9: Handling Slips

"This module will help you prepare to recover from missing doses or any other slip-up you may experience from your medical routine. If a lapse occurs, the best choice is to return to your adherence program as soon as possible instead of acting on hopeless thoughts and giving up. Identifying what led to the lapse can provide you with important information that can help solidify your coping skills and avoid future lapses. Lapses are normal and not a big problem. They only become a big problem when they lead to relapse and cause you to give up on your self-care regimen.

"Although you may expect that you will continually improve as your treatment progresses, this may not be the case. Everyone experiences ups and downs and good days and bad days. (click)

"This graph shows the difference between what most people who participate in this program believe their progress should look like and the reality of how progress usually happens. At times during your involvement with this program, you may experience a worsening of your symptoms or difficulty using the skills you've learned effectively. Instead of losing hope, look at these times as opportunities to gather information about what contributed to the negative change and use this knowledge to better prepare yourself in the future. Remember, lapses are completely normal. Over the long run, successfully dealing with short-term lapses will help you to maintain the positive results of your treatment. (click)

"Now, using page 14 in your workbook, think about the adherence goal of understanding that making a change takes time and practice-slips can happen. How would you feel if you didn't take your medications one day, either because you forgot or because you were sick and didn't feel like it? What would you do if that happened? (click)

"Next, identify potential barriers. What kinds of thoughts do you think may keep you from restarting your medical regimen if you have a slip? (click)

"Make a plan and back-up plan. What can you do to pick yourself up and start where you left off before you had a slip? When a slip occurs, try to avoid all-or-nothing thinking. What can you learn from a lapse that will help you avoid another in the future?

APPPENDIX H
Workbook

2010

Electronic Life Steps Workbook

A Guide for Improving Medication Adherence

Adapted from Coping with Chronic Illness: A Cognitive-Behavioral Therapy Approach for Adherence and Depression

Kasey R. Claborn, M.S. & Thad R. Leffingwell, Ph.D.
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About the Authors

Kasey R. Claborn, M.S., is a doctoral student in Clinical Psychology at Oklahoma State University. Kasey graduated from Texas Tech University with a Bachelor of Science degree in Human Development and Family Studies in December 2005. As an undergraduate, she conducted research on smoking cessation and the nicotine withdrawal syndrome. Under the direction of Dr. Thad R. Leffingwell, Kasey is currently interested in developing and examining the efficacy of brief interventions for health behavior change, including risky alcohol use and medication adherence among patients with chronic illness.

Thad R. Leffingwell, Ph.D., is a clinical psychologist and Associate Professor and Director of Clinical Training in the Department of Psychology at Oklahoma State University. Dr. Leffingwell completed his graduate training at the University of Washington and his pre-doctoral internship at the Puget Sound VA Healthcare System - Seattle. Dr. Leffingwell is a member of the *Motivational Interviewing Network of Trainers (MINT)*, having completed intensive training in how to train others in the approach. Dr. Leffingwell's research interests include brief motivational interventions for health behavior change and motivational predictors of self-directed and assisted behavior change. He has worked on five different federal, state and privately funded intervention projects that investigated adaptations of motivational interviewing.

About the Program

The *Electronic Life Steps* program is a computer-based adaptation of the empirically validated *Life* Steps intervention for medication adherence among patients with chronic illness. This program is designed to teach skills to manage HIV medication and improve the patient's ability to be consistent with taking medications long-term. This program and workbook incorporate cognitive behavioral treatment, motivational interviewing, and problem-solving strategies that target improving medication adherence in individuals living with HIV.

If you have HIV and are beginning a medication regimen, changing regimens, or have difficulty taking your medications as prescribed by your doctor, this program can help you manage your HIV properly and teach you the skills needed to take your medications as prescribed every day. Taking your medications consistently, or medication adherence, can be challenging, especially since you will need to take your anti-HIV medications long-term.

In this program, you will learn problem-solving methods to deal with side effects of the medications and some of the challenges that may cause you to miss doses of your medication or miss medical appointments with your doctor and other health-care providers. You will learn the importance of getting to your medical appointments, communicating with your treatment team, taking your medication on time every time, and storing your medicine properly and in a way that will keep your HIV status confidential. This program will give you tools to fight HIV and help you take the best possible care of yourself.

Exercise 1.1: Pros and Cons of Changing

	Pros	Cons
Changing Working to improve adherence		
Not changing Keeping things the way they are		

Exercise 1.2

Rate how motivated you are to work on improving your medication adherence on a scale of 1-10, with 1 representing no motivation to change at all and 10 representing high motivation to change.

Circle the number on the scale that BEST represents your motivation to work on improving your HIV medication adherence.

Problem Solving Worksheet 2.0

What thoughts do you have regarding adherence to your medical regimen (i.e., taking pills)?

1. _____
2. _____
3. _____
4. _____
5. _____

What may get in the way of adhering to your regimen? (Check all that apply)

☐ Your schedule	☐ Tendency to forget	☐ Negative thoughts
☐ Depression	☐ Alcohol use	☐ Substance use
☐ Side effects	☐ Number of pills	☐ Not motivated
☐ Stress	☐ Not knowing your regimen	☐ Not confident that you can do it

☐ Dosing restrictions (e.g., having to take with water or food, keep pills refrigerated, etc.)

☐ Other: _____

When you look at your medications and supplies, what goes through your mind?

1. _____
2. _____
3. _____
4. _____
5. _____

What are your top five reasons for staying adherent and taking care of your medical illness?

1. _____
2. _____
3. _____
4. _____
5. _____

Adherence Goals Worksheet 2.0

Generate a list of adherence, self-care goals and write them here.

Goal 1: _____

_____

_____

_____

Goal 2: _____

_____

_____

_____

Goal 3: _____

_____

_____

_____

Goal 4: _____

_____

_____

_____

Goal 5: _____

_____

_____

_____

AIM Method Problem-Solving 2.1

1. Articulate (write down) your adherence goal regarding medical appointments.

   _____

   _____

   _____

   a. How often do you have medical appointments?

   ☐ Every day ☐ Every month
   ☐ Once a week ☐ Every 3 months
   ☐ Every 2 weeks
   ☐ Other _____

   b. Where are they located? _____

2. Identify potential barriers.

   a. What might cause you to miss appointments? (Check all that apply)

   ☐ Don't have transportation ☐ Work schedule
   ☐ No child care ☐ Feeling tired
   ☐ Feeling depressed ☐ Forgetting appointments
   ☐ Other _____

   b. Does your work schedule conflict? ☐ Yes ☐ No
   c. Do you live very far away? ☐ Yes ☐ No

3. Make a plan and a backup plan.

   Plan: _____

   _____

   Backup Plan: _____

   _____

AIM Method Problem-Solving 3.1

1. Articulate (write down) any questions or comments that you would like to ask or discuss with your medical provider.
    a. What questions do you want to ask about your symptoms?

    _____

    _____

    b. What questions do you want to ask about your medications?

    _____

    _____

    c. What questions do you want to ask about your side effects?

    _____

    _____

    d. What questions do you want to ask about your recommended self-care behaviors?

    _____

    _____

2. Identify potential barriers to communication with your medical provider.
    a. Do you feel uncomfortable talking to your doctor? ☐ Yes ☐ No
    b. Do you feel that he or she is too busy to talk to you? ☐ Yes ☐ No
    c. Do you tend to forget what you want to ask? ☐ Yes ☐ No
    d. What are some additional barriers? _____

    _____

    _____

3. Make a plan and a backup plan.

    Plan: _____

    _____

    Backup Plan: _____

    _____

AIM Method Problem-Solving 4.1

1. Articulate (write down) any problems with adherence that may emerge due to side effects.
   a. What kinds of side effects do you experience? (Check all that apply)

☐ Headaches	☐ Nausea	☐ Diarrhea	☐ Vomiting
☐ Abdominal pain	☐ Rash	☐ Fatigue	☐ Insomnia
☐ Dizziness	☐ Loss of appetite	☐ Burning sensations	☐ Anemia
☐ Vivid dreams	☐ Depression	☐ Flu-like symptoms	☐ Weakness

   ☐ Other: _____

   _____

   b. Which of your medications do you think are causing the side effects?

   _____

   _____

2. Identify potential barriers.
   a. Have your side effects gotten in the way of taking your medications?

   ☐ Yes ☐ No

   b. Have you ever missed a dose because of experiencing side effects?

   ☐ Yes ☐ No

   c. What have you done about the side effects so far?

   _____

   _____

   Have you been able to talk to your doctor about them? ☐ Yes ☐ No

3. Make a plan and a backup plan.

   Plan: _____

   _____

   Backup Plan: _____

   _____

AIM Method Problem-Solving 5.1

1. Articulate (write down) the adherence goal of always having a sufficient supply of medications and needed products.
   a. Where do you get your medications and medical supplies?
      ☐ Local Pharmacy ☐ Mail-in ☐ Clinic
      ☐ Other: _____
   b. How do you pay for them? _____
   c. How do you get to your pharmacy?
      ☐ Drive myself ☐ Bus ☐ Have someone else drive me
      ☐ Walk ☐ Ride bike ☐ Other: _____

      Have you ever run out of your medications or medical supplies? ☐ Yes ☐ No

   d. When do you ask for a medication refill from your pharmacy? _____
   e. When do you ask for a refill from your doctor? _____

2. Identify potential barriers.
   a. What might cause you to run out of your medications or other needed medical supplies?

      _____

      _____

   b. What might get in the way of getting to your pharmacy? (Check all that apply)
      ☐ Bad weather ☐ Lack of transportation ☐ Work schedule
      ☐ Lack of childcare ☐ Being too busy ☐ Depression
      ☐ Other: _____

3. Make a plan and a backup plan.

   Plan: _____

   _____

   Backup Plan: _____

   _____

Medical Regimen Schedule Worksheet 6.1

Day of the week: _____

Adherence Goals: _____

_____

_____

_____

Time	Daily Activity	Adherence Goal
Morning		
Afternoon		
Evening		

Medical Regimen Schedule Example 6.2

Day of the week: Tuesday

Adherence Goals: Take all prescribed medications
Practice adaptive thoughts
Increase physical activity

Time	Daily Activity	Adherence Goal
Morning		
6:30	Wake up & use bathroom	Practice adaptive thoughts
7:00	Get dressed	
7:30	Eat breakfast	Take morning medications
8:00	Drive to work	
9:00	Arrive at work	
10:00	Work	
11:00	Snack break	
Afternoon		
12:00	Work	
1:00	Lunch	
2:00-4:00	Work	
4:00	Snack break	Practice adaptive thoughts
5:00	Leave work	
Evening		
6:00	Go to gym	Physical activity
7:00	Eat dinner	Take evening medications
8:00-10:00	Watch TV	
10:00	Read the paper	
10:30	Get ready for bed	Practice adaptive thoughts
10:45	Go to bed	

*Example of Completed Medical Regimen Schedule for a patient with HIV

AIM Method Problem-Solving 6.3

1. Articulate (write down) the adherence goal of remembering to take your medication and follow your medical regimen.

   _____

   _____

   _____

   a. When do you take your medications? (Check all that apply)

   ☐ In the morning ☐ In the afternoon ☐ In the evening
   ☐ Before going to bed

   b. How do you remember to take your medications? _____

   _____

2. Identify potential barriers.

   a. When do you tend to forget to take your medications?

   ☐ On the weekends ☐ During holidays ☐ On vacations
   ☐ At work ☐ In the mornings ☐ In the evenings
   ☐ When I am out with friends or family
   ☐ After consuming alcohol or other substances
   ☐ Other: _____

   b. Do you usually take your medications when you are doing something else?

   ☐ Yes ☐ No

   If yes, what are you doing when you take your medications?

   _____

   _____

3. Make a plan and a backup plan.

   Plan: _____

   _____

   Backup Plan: _____

   _____

AIM Method Problem-Solving 7.1

1. Articulate (write down) the adherence goal of properly storing medications, even when you are not at home.

   If you leave home, do you take medications with you if you know you will not be back in time for your dose? ☐ Yes ☐ No

   a. How do you *carry* your medications or medical monitoring devices with you when you go out?

   ☐ In a purse ☐ In a lunchbox ☐ In a briefcase
   ☐ In a pillbox ☐ In a Ziplock bag ☐ In a backpack
   ☐ I do not carry my medications or supplies with me when I go out because I am afraid someone will find out that I am HIV positive.
   ☐ I do not carry my medications or supplies with me when I go out because I do not need to.
   ☐ Other:_____

2. Identify potential barriers.
   a. How do you *take* your medications with you when you go out?

   _____
   _____

   Do any of your medications need to be refrigerated? ☐ Yes ☐ No

   b. What will you do about storing medications when you are away from home?

   _____
   _____

3. Make a plan and a backup plan.

   Plan: _____

   _____

   Backup Plan: _____

   _____

AIM Method Problem-Solving 8.1

1. Articulate (write down) the adherence goal of using strategies for improving your motivation to take medications and for remembering to take them.
    a. How do you usually help remind yourself to take your medications?

    _____

    _____

    b. What do you think about when you know it is time to take your medications?

    _____

    _____

2. Identify potential barriers.
    a. What things do you think may keep you from using the dots?

    _____

    _____

    b. Do you think the dots would be helpful reminders to take your medications?

    ☐ Yes ☐ No

3. Make a plan and a backup plan.

    Where can you place each dot so that you can see it at each dosing time?
    Plan: _____

    _____

    What other things do you think you can use to help you remember your medications?
    Backup Plan: _____

    _____

AIM Method Problem-Solving 9.1

1. Articulate (write down) the adherence goal of understanding that making a change takes time and practice—slips can happen.
    a. How would you feel if you didn't take your medication one day, either because you forgot or because you were sick and didn't feel like it?

    _____

    _____

    b. What will you do in that situation?

    _____

    _____

    _____

2. Identify potential barriers.
    a. What kinds of thoughts do you think may keep you from restarting your medical regimen if you have a slip?

    _____

    _____

    _____

3. Make a plan and a backup plan.

    What can you do to pick yourself up and start where you left off before you had a slip?
    Plan: _____

    _____

    What can you learn from a lapse that will help you avoid another in the future?
    Backup Plan: _____

    _____

VITA

Kasey Renee Claborn

Candidate for the Degree of

Doctor of Philosophy

Thesis: RANDOMIZED CLINICAL TRIAL EXAMINING THE EFFICACY OF AN ELECTRONIC INTERVENTION FOR HIV MEDICATION ADHERENCE

Major Field: Clinical Psychology

Biographical:

Personal Data:

Education:
Completed the requirements for the Doctor of Philosophy in Clinical Psychology at Oklahoma State University, Stillwater, Oklahoma in July, 2013.

Completed the requirements for the Master of Science in Psychology at Oklahoma State University, Stillwater, Oklahoma in July 2009.

Completed the requirements for the Bachelor of Science in Human Development and Family Studies at Texas Tech University, Lubbock, Texas in 2005.

Experience: Psychological Associate at Psychological Services Center, Oklahoma State University, Stillwater, Oklahoma, 2007-2012; Behavioral Health Intern at Indian Health Care and Resource Center, Tulsa, Oklahoma, 2009-2010; Practicum Therapist at Internal Medicine Specialty Services, Oklahoma State University Center for Health Sciences, Tulsa, Oklahoma, 2010-2011; Practicum Intern at the Alcohol and Substance Abuse Center, Oklahoma State University, Stillwater, Oklahoma, 2011-2012; APA-approved pre-doctoral internship at University of Florida Health Sciences Center, Gainesville, Florida, 2012-2013.

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Name: Kasey Renee Claborn Date of Degree: July, 2013

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Title of Study: RANDOMIZED CLINICAL TRIAL EXAMINING THE EFFICACY OF AN ELECTRONIC INTERVENTION FOR HIV MEDICATION ADHERENCE

Pages in Study: 177 Candidate for the Degree of Doctor of Philosophy

Major Field: Clinical Psychology

Scope and Method of Study:

Widespread dissemination of current efficacious interventions designed to improve HIV medication adherence is limited by several barriers including additional time and expense burdens on the health care systems. Electronic interventions could overcome these barriers and aid in dissemination of an efficacious intervention in the clinic setting. This study developed a computer-based intervention based upon a known efficacious intervention and tested the feasibility, acceptability, and initial efficacy of this program. HIV+ men and women (N=92) on antiretroviral therapy (ART) with self-reported adherence <95% were randomized to intervention or treatment as usual. The primary outcomes were self-reported ART adherence and self-efficacy.

Findings and Conclusions:

Participants in the intervention condition reported higher levels of self-efficacy at follow-up compared to the control condition. Although nonsignificant, trends were identified in improved levels of adherence over time in the intervention condition, while TAU adherence remained constant. This was the first study to investigate a single-session computer-based adherence intervention. Results suggest that electronic interventions are feasible and this method may be effective at increasing self-efficacy and adherence levels.